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Engineers Do It All!

Headquarters, Department of the Army
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Engineer (ISSN 0046-19890) is prepared quarterly by the U.S. Army Maneuver Support Center, 320 MANSCEN Loop, Suite 210, Fort Leonard Wood, MO 65473-8929. Second Class postage is paid at Fort Leonard Wood, MO, and additional mailing offices.

POSTMASTER: Send address changes to U.S. Army Maneuver Support Center, ATTN: ATZT-DT-DS-B *(Engineer)*, 320 MANSCEN Loop, Suite 210, Fort Leonard Wood, MO 65473-8929.

CORRESPONDENCE, letters to the editor, manuscripts, photographs, official unit requests to receive copies, and unit address changes should be sent to *Engineer* at the preceding address. Telephone: (573) 563-4104, DSN 676-4104. *Engineer's* e-mail address is: *bridgess@wood.army.mil.* Our Internet home page is located at: *http://www.wood.army.mil/engrmag/emag_hp.htm.*

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ENGINEER

The Professional Bulletin of Army Engineers

January-March 2003 Headquarters, Department of the Army *Volume ~~32~~ 33 PB 5-03-1*

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Front Cover: *Engineers perform a variety of missions.*

Back Cover: *Soldiers from the 60th Engineer Battalion assist German civilians in the town of Sterkrade. 30 March 1945*

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Clear The Way

By Major General R.L. Van Antwerp
Commandant, U.S. Army Engineer School

In the last issue, we started a discussion on this page on one aspect of how we intend to change the organization and operations of the Regiment as we transform the Army. From that, and from many other venues, we have received lots of great feedback on those thoughts from the field, and I really appreciate it. The strength of our Regiment has always been—and will always be—our people, and your thoughts reflect that strength.

The key concepts from the last issue are perhaps best described as ***force pooling*** and ***modularity***. In this issue, I want to open a discussion with you on the ideas of what ***information superiority*** can really do for us in the future. Let's look at it from today's perspective first.

In the past, the Army wrote combined-arms warfighting doctrine, knowing that we would not have real information superiority. The reason we, the mobility and countermobility BOS, fight the way we do is that, in many ways, we are reacting to the enemy's efforts. Through very sophisticated efforts, we seek to put mobility assets in the right formations so they can be at the right place and time on the battlefield with the right tools and techniques to overcome enemy countermobility efforts. But what that means is that the enemy has already conducted countermobility operations, and now we must reactively task-organize to perform mobility operations for our maneuver forces. Thus, mobility operations were, at best, described as predict/confirm, avoid if possible (bypass), and neutralize by breaching. Fundamentally, that's a reactive way of doing business. And many of us have experienced the tremendous frustration of having some part of that approach break down.

With the information superiority that underlies the Objective Engineer Force, we are trying to achieve a much more proactive approach. If we know what the enemy is capable of doing and how he typically does it, and we see indicators of what he is getting ready to do, then we can be proactive. With this information superiority, we have the ability to *predict* his efforts, search for and *detect* them, *prevent* them, *avoid* them altogether or *neutralize* them, and *protect* our soldiers in this effort. This simple description of predict, detect, prevent, avoid, neutralize, and protect is part of the broader concept of assured mobility, but it represents how we can use information superiority to operate. Using a tactical example, with advanced C4ISR technology, we are able to *predict* and *detect* enemy countermobility operations that will affect us. When we do detect enemy sappers moving out to place minefields in a maneuver corridor we must use, we *prevent* the operations by using systems to destroy those sappers. Let's say that for some reason we don't get them all, and some minefields are emplaced. Then, using ASTAMIDS, GSTAMIDS, HSTAMIDS, and C4ISR to precisely locate the minefields allows us to *avoid* them. If that avoidance cannot be achieved, we will use that information to *neutralize* the mines on our approach. We might maneuver forward an unmanned mine neutralization vehicle controlled remotely to destroy the mines in our path. And finally, in addition to neutralizing the danger of the obstacle, we will develop vehicles that can *protect* the lives of our soldiers by withstanding the effects of a mine blast. This is but one example of the difference on a tactical level.

Today, I think we are seeing some aspects of that ability to develop information, apply knowledge to it, and enable proactive operations. And I'm not just talking about information-processing systems. I think we are seeing it in such areas as increased initiative and flexibility in real-world missions, tremendously improved situational awareness/understanding, and so on. But that's just an echo of what we could be. Essentially, information superiority will allow us to see first and understand and then be able to act first and finish decisively (the proactive part). I believe it is easy to see that this is an important departure from the past, but one that is challenging on all levels—strategic, operational, and tactical. With that challenge, we need all engineer leaders to look toward the future.

We have to address this all the way from the physical act of seeing (sensors of every type, from human to stationary to robotic, from national to tactical) through the analysis and distribution (and we all know that's really tough business) to the ability for a commander to see all that and decide what to do (we call it battle command). That's a serious set of ideas, but the combat power in such an approach simply cannot be denied. We want to be part of that combat power, so think about it, talk about it, work on it, and tell us here at the school about it. After all, people are the absolute key to information as part of combat power.

Thanks, and I look forward to hearing from you.

Essayons!

Lead The Way

By Command Sergeant Major William D. McDaniel, Jr.
U.S. Army Engineer School

Let me begin by saying that I am extremely proud and excited to have the opportunity to serve the U.S. Army Engineer School and our distinguished Regiment as your new Regimental Command Sergeant Major (CSM). I look forward to the challenges that lie ahead and the professional interaction with MG Van Antwerp and BG Castro.

During my interview with MG Van Antwerp and BG Castro, I told them that I feel this position is larger than the soldier who serves in it and that the Regimental CSM is a reflection of all enlisted soldiers. He serves as a senior enlisted adviser to our Commandant and Assistant Commandant, while thoroughly involved with all aspects of the Regiment. I informed them that I am a soldier with lots of energy who wants to make a positive difference for all the members of our great Regiment. I told them that I don't know all the answers but what I do know is that I love being a soldier. And because of this passion, I will continue to embrace every challenging position with absolute commitment and selfless service.

I often say that throughout our careers we never know how it will end up but that we will always strive to make a positive impact in our ranks every day. Certain events in our lives shape us, our leaders challenge us, our mentors guide us, our spiritual beliefs ground us, and our families love and support us. All of these important elements make us who we are today, and I challenge all of you to maintain that balance in your lives.

I also challenge all of you to seek out a leader as a mentor, particularly one that you have served with and respect. I have had several mentors, and I have always looked to them for guidance and feedback throughout my years. Many are retired now, but they all played an important part in who I am as a leader.

As we all know, our branch is very diverse, and it also has the largest number of Reserve Component organizations. I recently attended the Sergeant Major of the Army (SMA) Nominative CSM Conference at Fort Bliss, Texas. The SMA continually stated that we are one Army, regardless of component. It is important to note that we do not just give this lip service. I represent all engineer soldiers—Active, Guard, and Reserve (past and present). I am a leader who gets involved to effect the necessary change within our Regiment in the best interest of all. In saying this, we all need to understand that we must speak with one voice. Once our Commandant has made a decision, then we need to get onboard as a team. This will allow us to tackle the complex issues that face us now and in the future from all fronts.

Since moving into this position on 5 November 2002, I have been engaged with leaders and soldiers while I traveled to the Corps of Engineers Headquarters, PERSCOM, Fort Bragg Special Forces Training Center, the 420th Engineer Brigade Leader Conference, and the Fort Bliss SMA Nominative CSM Conference. I visited Germany to participate in the activation and assumption of command ceremony of the 18th Engineer Brigade on 21 January. Then I traveled throughout Germany and Kosovo from 21-28 January to visit our soldiers and talk to their leaders. Here at Fort Leonard Wood, I participated in the Joint Countermine Conference and in a session with the Precommand Course for our inbound battalion commanders.

I will continually get out and visit the soldiers of engineer organizations around the world and report the key issues back to the Commandant and Assistant Commandant. We will work the hard issues that impact our leaders and soldiers daily and leverage the directorates within the Engineer School to identify solutions to resolve these issues. In saying all of this, we do not make this happen by ourselves; it takes a dedicated team of professionals within our School. They are the heroes behind the lines, engaged in solving the many issues that impact our soldiers.

It is important for us to say thank you to a couple of great leaders—CSM Dils and CSM Robinson—who both recently retired with 30-plus years of service. Speaking for all soldiers in the Regiment, we want to thank you for your faithful and honorable service to our nation, the U.S. Army, the Corps of Engineers, and the Engineer Regiment. You and your families have made many sacrifices, and you all have made such a tremendous impact on countless numbers of soldiers and families throughout your career. You are professional soldiers, role models, mentors, and superb leaders. We send our very best to you and your families during your transition into retirement.

We also need to welcome our new Corps of Engineers Command Sergeant Major, CSM Michael Balch. I look forward to working with him.

Today, as always, our Regiment is extremely busy with supporting our nation's war on terrorism, while at the same time transforming our Army and our Regiment. Our thoughts and prayers go out to all the soldiers on point around the globe and to all their families during their separation.

Remember to always think safety as we accomplish our required missions, regardless of where we find ourselves. Take care of your soldiers, yourselves, and your families. I look forward to our future together in the greatest Regiment in our Army!

Essayons!

Planning Engineer Support for an Urban Attack

By Captain John C. DeJarnette

This article was originally published in Engineer, July 1998, PB 5-98-3, U.S. Army Engineer Center and Fort Leonard Wood, Missouri. A revised version appeared in CALL Newsletter No. 99-16: Urban Combat Operations; Chapter 6: Mobility and Survivability. Since this article was written, FM 90-13-1 has been superseded by FM 3-34.2, Combined Arms Breaching Operations, and FM 90-10-1 has been superseded by FM 3-06.11, Combined Arms Operatons in Urban Terrain. Please read the article on page 10 to learn how doctrine has changed concerning urban operations.

Today's soldiers must be prepared to fight on oncreasingly diverse terrain, including terrain containing man-made features found in urban areas. These elements are viewed as obstacles to maneuver. Military operations on urbanized terrain (MOUT) encompass all military actions planned and conducted on a terrain complex where man-made construction impacts on the tactical options available to a commander.

This article provides considerations for engineer planners and leaders to employ when battalions and brigades attack built-up areas. It is intended to amplify current doctrine outlined in FM 90-10-1, *An Infantryman's Guide to Combat in Built-Up Areas (with Change 1)*. Lessons are drawn from observing attacks on the Shugart-Gordon MOUT training facility at the Joint Readiness Training Center.

Mission Analysis

Mission analysis sets the conditions for planning and ultimate success of MOUT operations. All planners must identify specified, implied, and essential tasks as well as constraints and limitations. Well-prepared engineer battlefield assessments (EBA) and terrain analysis products are essential to successful MOUT planning. Answering the following questions will help engineer planners, in conjunction with the principal battle staff, develop an effective MOUT offensive mission analysis:

☐ **Where is the key/decisive terrain?** Identify this terrain for the approach march and for seizing buildings. Conduct a line-of-sight analysis along the route and compare it to the enemy template.

☐ **Where are the best obstacle reduction sites and support-by-fire positions for securing a foothold?** Consider the terrain, the enemy force template, and massing fires. Determine the minimum engineer force required to seize a foothold, seize essential facilities, and provide mobility support to mounted forces, such as how to sequence engineer tasks and change the engineer task organization to accomplish essential tasks. Identify the key leaders required to facilitate command and control of critical events and task organization changes. Decide how to best integrate cannon-delivered smoke, hand-emplaced smoke, and smoke generators to conduct breaching operations.

☐ **How should subordinate units execute in-stride versus deliberate breaching operations based on the enemy template and results of reconnaissance and surveillance (R&S) efforts?** Decide where to use the mine-clearing line charge (MICLIC), tank-mounted countermine equipment, and manual breach techniques. Balance exposure of the breach force to enemy fires with the probability that a system may be killed before it can be employed.

☐ **How will reconnaissance forces link up, guide, or mark obstacles for bypass/breaching operations.**

☐ **What are the counterattack routes of the enemy force?** Consider the terrain and weather. Determine if enemy counterattack routes can be used to move friendly combat service support assets based on the enemy event template and time phasing of the counterattack. Determine what situational obstacles (rapid mining, scatterable mining) the enemy counterattack force has available.

☐ **What is the safety zone and trigger for using scatterable mines?** Ensure that this information is disseminated at all rehearsals.

☐ **What is the composition of the buildings to be attacked?** Determine the effects weapons will have on these structures (this drives the selection of fuze/shell combinations and aircraft attack munitions).

☐ **What is the "layout" of the town both above and below ground?** Determine the protected areas, such as churches, hospitals, and museums. Sources for this information are imagery from the division, gun camera tapes from OH-58/H-64 helicopters, Michelin road maps, and tour books.

Support Products

The engineer staff planner uses the following products developed to support the military decision-making process (MDMP). All of these products must be developed in conjunction with the S2. These products are updated based on the results of reconnaissance and surveillance.

Engineer Battlefield Assessment

The EBA feeds many of the subsequent products. Clearly articulate the enemy engineer capability based on the most likely and most dangerous courses of action. Consider past experience with this enemy, his current strength, anticipated barrier material basic loads, expected resupply rates, and locally available materials he can use to prepare his defense. This information will support development of the situation template (SITEMP).

Identify friendly engineer capabilities for mobility, countermobility, and survivability operations. Explicitly state the number and types of breaches each engineer unit is capable of executing based on its personnel, equipment, and logistical status. Leader proficiency and audacity impact this estimate, so plan two levels down based on the particular unit. Use this information to develop the task organization later in the MDMP.

Estimate the impact of terrain and weather on both friendly and enemy capabilities. Line-of-sight, hydrology, cross-country movement, and line-of-communication overlays are helpful and can be provided by the division terrain detachment or quickly approximated from maps.

SITEMP

Know the enemy capability based on an estimated unit basic load of Classes IV and V materials and anticipated resupply. The time available to prepare the defense is essential. Reconnaissance assets should observe the delivery and emplacement of barrier materials. The S2 and the engineer template enemy obstacles and counterattack routes based on terrain and weather conditions. Determine what resources are available in the MOUT area (ammonium nitrate, acetylene, propane, lumber yards, jersey barriers, vehicles, and construction equipment) that can contribute to enemy defensive preparation.

Based on this analysis, the engineer and S2 jointly template the enemy engineer countermobility/survivability capability on the SITEMP. It should include minefields, tactical and protective wire obstacles, and vehicles and other barriers in roads. This overlay is used to plan the engineer task organization, because this and the friendly scheme of maneuver determine the number of sapper squads needed and where mobility assets are placed in the movement.

Time and materials will impact enemy defensive capability. The force array in the security zone and main defensive belt impacts the amount of defensive preparation. Indirect-fire systems can only service one priority target and must shift to cover other targets, which may help with refining the obstacle template. Locations and movement of mounted weapons may indicate usable lanes for friendly infiltration of vehicles.

Event Template

Determine what triggers the commitment of enemy counterattack forces. The engineer planner can assist the S2 in determining what situational obstacle capabilities he has, where and for what purpose the capabilities will be committed, and what the triggers are. Determine the structures likely to be set for destruction (such as petroleum and natural gas storage facilities).

Friendly Forces Survivability Time Line

The engineer and the S4 plan to construct positions to support the forward displacement of combat support and combat service support assets and limited command and control nodes. The survivability effort should be an essential part of the maneuver deception plan.

Breach Execution Matrix

This matrix helps the task force allocate engineer assets and determine when in-stride and deliberate breach techniques are required. Specify where to use MICLIC, hand-emplaced explosives, armored combat earthmover (ACE), armored vehicle-launched bridge (AVLB), and tank-mounted countermine equipment to reduce enemy obstacles. It is important to keep in mind that rubble can be a more significant obstacle than conventional mines and wire obstacles.

Decision Support Template/Decision Support Matrix

Help the S3 identify and plan viable branches and sequels to the plan. It is essential to know where engineers will culminate and how rapidly engineer platoons can be consolidated, reorganized, and put back into the fight.

Execution Checklist/Operations Schedule

Develop with the S3 the operations schedule (OPSKED), which is a combination of key events from the synchronization matrix and associated code words. This product supports the decision support template and helps the battle captain and maneuver commander track the battle and make decisions. Prepare a rough execution checklist after receiving the warning order and continue to refine it during mission analysis. Finalize the checklist during wargaming and provide "bootleg" copies to task force engineers and squad leaders (see page 7).

Troop-Leading Procedures Timeline

Ensure that adequate time is available for engineers to both prepare the task force rehearsal site and conduct their own internal rehearsals.

R&S Planning Considerations

Integrate engineer reconnaissance teams into the brigade R&S plan. Focus these teams on engineer targets such as landing zone denial, obstacles in the reduction area, enemy survivability on the objective, and obstacles on approach routes. The named areas of interest (NAI) assigned to engineers should have priority intelligence requirements (PIR) that determine the best reduction sites in the city and confirm or deny enemy fortification of key sites.

Precombat Inspections (PCIs)

After conducting precombat checks (PCCs), inspect materials used to mark obstacle bypass lanes. Conduct FM radio communications exercises using the OPSKED and reports specific to the current operation. Inspect all maps for operations security considerations. Sterile maps are not required, but information provided on overlays should not compromise the attack plan. Overlays should portray only NAIs. Targets, pickup and landing zones, and link-up locations should not be on overlays taken into the objective area. All soldiers must clearly understand the NAI priority and associated PIR, casualty evacuation (CASEVAC) plan, abort criteria, compromise plan, exfiltration and link-up plan, and communications windows.

Mobility Planning Considerations

Providing mobility support to a maneuver force in a MOUT environment normally will require engineers to support multiple combined-arms breaching operations. The reverse planning process discussed in FM 90-13-1, *Combined-Arms Breaching Operations*, applies to all terrain situations. The following considerations complement this process:

Conduct Approach March

Plan a primary route and an alternate route to support the movement of each maneuver battalion's combat forces. Clear these routes using standard tactics, techniques, and procedures (TTP). Control of movement routes is critical, particularly when ground evacuation is the primary method of removing casualties. Coordinate one-way, two-way, and alternating-direction traffic on routes with the brigade executive and operations officers. Identify decision criteria for switching to alternate routes. Maximize aerial reconnaissance of routes to identify possible obstacles, combat outposts, and ambushes.

Precombat Inspections. Conduct standard route-clearance PCCs and PCIs, which should be listed in the unit SOP. As a minimum, check initiation systems, demolition charges, reduction equipment, marking materials, and mine detectors.

Rehearsals. The engineer, with the S3, ensures that all of the breach tenets and control measures are understood by key leaders at the task force rehearsal.

Secure the Foothold

Create lanes through obstacles using one sapper squad per lane, with a minimum of one lane per simultaneously assaulting platoon. (This does not mean nine lanes per infantry battalion. Analyze carefully.) Use adequate marking materials, guides for assault and follow-on forces, and lane hand-over procedures. It takes at least 30 minutes to "cycle" this squad back into the fight.

A squad cannot support breaching operations continuously. A decision point or trigger must support any changes in task organization and missions for engineers. Establish decision points for changing approach routes and reduction sites and initiating the breaching fundamentals—suppress, obscure, secure, reduce (SOSR).

Precombat Inspections. Equip the unit with bolt cutters (two per engineer squad), grapnels (three per engineer squad), a lane-marking kit, hand-emplaced explosives (10 per squad per lane), mine detectors, and probes. Ensure that handheld smoke is available for each infantry soldier and that vehicles or utility helicopters carry smoke pots. Mass this smoke with the breach force at the objective rally point. Ballast load marking system upgrade materials on gun trucks. Use expedient reduction tools, such as Skidco litters, for wire reduction.

Rehearsals. No matter what rehearsal type or technique is used, perform basic SOSR rehearsals. (See FM 101-5, *Staff Organization and Operations*, Appendix 6, for more information on rehearsals.)

Suppress. Ensure that all personnel understand the location of support-by-fire positions and the pyrotechnic and radio signals to initiate obstacle reduction and indicate when the lanes are open (proofed and marked). The rehearsal site should have a full-scale lane-marking system visible to every soldier. All key leaders should understand the commitment criteria for the breach force.

Obscure. Rehearse triggers for artillery-delivered, hand-emplaced, and vehicle-generated smoke. Consider the position of the moon relative to the support-by-fire position, the percent of illumination, and the night-vision goggle window.

Secure. Hold a combined-arms rehearsal of the breach force using the full-dress technique. This rehearsal includes engineers and attached maneuver elements dedicated to suppressing direct fires and destroying local counterattacks.

Reduce. The combined-arms rehearsal should include handing over lanes from engineers to maneuver soldiers. The rehearsal should be "NCO to NCO" and details of

Engineer Staff Planning Checklist (Brigade and Below)

Plan

General

☐ Identify and resource all mobility/survivability essential tasks.

☐ Address all the breach tenets during planning and rehearsals.

☐ Request terrain products, MOUT layout diagrams, and data on building composition from higher headquarters.

☐ Study available terrain products to determine which subsurface routes to use and how to defend against enemy use of these systems.

☐ Study available maps and photos to determine the best routes to use when approaching the city and within the city. Determine where to establish casualty collection points, aid stations, and ammunition and water resupply points.

☐ Use scatterable mines to support engagement areas that block mounted counterattack routes. Disseminate this plan to critical maneuver and combat service support leaders.

☐ Establish essential engineer friendly forces' information requirements and no-later-than report times.

☐ Nominate engineer-specific PIR and associated NAIs to support the reconnaissance plan. Ensure that the latest time information of value (LTIOV) is clearly understood. Decide what actions to take if the PIR are not answered before LTIOV.

☐ Disseminate the enemy obstacle template to all engineer leaders.

☐ Task-organize engineers to support essential mobility/survivability reconnaissance missions.

☐ Determine how much and what types of obscuration smoke are available. Determine the wind direction and speed, which will impact the effects of smoke. Coordinate with the fire support officer for recommended uses of white phosphorus (both mortar and artillery-delivered) and handheld smoke. Coordinate with the smoke platoon leader for duration of smoke and level of obscuration.

☐ Designate and clear routes for mounted forces and reserve forces.

☐ Identify the "conditions" and a decision point for initiating deliberate breaching operations during each critical event of the operation.

Approach March

☐ Designate routes for ground convoys and allocate engineers to clear them.

☐ Determine the clearance method and acceptable risk.

☐ Ensure that all vehicles have lane- and bypass-marking materials on board.

☐ Designate ground CASEVAC routes.

☐ Determine the decision point for using alternate routes.

☐ Determine when to establish traffic control posts (TCPs)/guides at critical obstacles on the route.

☐ Establish NAIs along the ground route to confirm or deny the enemy obstacle template.

Secure the Foothold

☐ Designate the best reduction site and technique based on enemy force array, terrain, and trafficability.

☐ Nominate NAIs for breaching operations.

☐ Designate one lane for each simultaneously assaulting platoon and the engineers needed to reduce it.

☐ Explain the lane-marking system.

☐ Establish a traffic-control plan for dismounted and mounted traffic.

☐ Establish a vehicle route and a dismounted route from the foothold to the CASEVAC helicopter landing zone.

☐ Designate locations for blocking positions to keep counterattacks from interfering with breaching operations. Resource blocking positions with MOPMS, conventional mines, and expedient barrier capability (such as abatis). Depict the planned locations of scatterable mines (include the safety zone) on maneuver and combat service support graphics to reduce fratricide.

Seize Key Facilities

☐ Designate buildings to enter and a reduction site that will support maneuver to the point of penetration.

☐ Designate where the support force will enter buildings.

☐ Resource battalions and their engineers with sufficient explosives and hand-emplaced and artillery smoke.

☐ Explain the cleared-building and cleared-lane marking systems.

Prepare/Execute

☐ Construct appropriate rehearsal sites to support maneuver and combat service support operations.

☐ Provide enough detail in the troop-leading procedure timeline to encourage both engineer and combined-arms rehearsals.

☐ Issue sketch maps and terrain products to engineers.

☐ Construct a lane-marking system and bypass-marking system that all vehicle drivers must go through en route to the objective area.

☐ Provide enough detail in the maneuver and engineer execution checklists to effectively use the Decision Support Matrix.

☐ Specify times for engineer-specific PCIs conducted by platoon leaders, company commanders, and first sergeants.

"Providing mobility support to a maneuver force in a MOUT environment normally will require engineers to support multiple combined-arms breaching operations."

linkup and handover should be discussed. Consider the need to back-haul casualties when planning the number of lanes.

Seize Key Facilities

Plan procedures for dynamic entries into buildings and vertical envelopment, which require prepared special demolition charges (see FM 90-10-1, Change 1), expedient assault ladders, and climbing grapnels. Rehearse the TTP for getting into windows on second and third floors. Have cutting tools available to prepare climbing poles at the objective rally point. Plan for subsurface entry. Consider the use of reducing wire in stairwells and hallways.

Precombat Inspections. Inspect special breaching charges (see FM 90-10-1, with Change 1). Ensure that charges are properly constructed and that they will "stick" when placed. Use double-sided foam tape when placing vertical breaching charges during warm, dry conditions. Use spikes, braces, or Ramset-type power-actuated fasteners during rain or when temperatures are below freezing. Ensure that sufficient handheld and hand-emplaced smoke is available. Maneuver soldiers can carry smoke pots and additional explosives. Where practical, use battering rams (picket pounders or equipment found in MOUT areas) to enter doors. Conserve explosives by bringing one or two 24-inch crowbars to lift manhole covers and pry open entryways to buildings and sewers. Provide night-vision goggles to soldiers who reduce obstacles, because infantry leaders use infrared "tactical pointers" extensively, and reduction element soldiers must be able to see these signals. Use all available infrared lights. Mount and zero all AN/PAQ-4s and AN/PVS-4s during the preparation phase of the mission. Engineers must bring handheld infrared light sources (such as Phantom lights or infrared filters on Maglites) and visible light sources (D-cell Maglites or SureFire TAC lights) to help move and reduce obstacles inside buildings and subsurface structures. Ambient light inside hallways and underground is virtually zero, so plan for additional light sources. Mark cleared buildings so the marking is visible from rotary-wing aircraft and armored vehicles and by dismounted soldiers.

Rehearsals. Focus on the location and control of support forces and signals for committing the breach force. Ensure that soldiers understand the minimum safe distance and the best reduction site based on the building structure. Clearly identify routes between buildings and the marking method for "safe routes." Deconflict building clearance markings from collection points for casualties, displaced civilians, and enemy prisoners of war. Rehearse close quarters combat drills for interior building clearing. Basic SOSR rehearsals from "secure the foothold" apply to dynamic entry into buildings, but these rehearsals usually focus on the infantry platoon and an engineer squad.

Civilians on the Battlefield/Enemy Prisoners of War. Establish "protected areas" for civilians on the battlefield, and clearly mark routes for displaced civilians. Consider an expedient countermobility effort to restrict access to these civilians and enemy prisoners of war. Liaison officers from psychological operations, civil affairs, and the military police should address this topic in the brigade maneuver rehearsal. Although there are no specific engineer requirements, be prepared to provide technical assistance during planning and execution phases.

Subsurface Fight. This is a variation on the theme of clearing buildings. Salient points are entering the tunnel or sewer complex using hand tools or explosives, identifying and neutralizing mines and booby traps, and marking cleared areas. Navigation inside sewers and radio communications from inside the tunnel to aboveground soldiers is challenging. There is no ambient light inside tunnels, so plan and rehearse using infrared and visible light signals.

Move Within the City

Plan one vehicle lane per mounted platoon entering each section of the city. The lane through tactical and perimeter protective obstacles will become an "axis" for movement within the MOUT area. These lanes initially will support one-way traffic. Plan and rehearse traffic control as lanes become alternating traffic lanes to allow for CASEVAC. Improve at least one lane to two-way traffic and designate this as the primary CASEVAC route. Designate, clear, and mark a route from the casualty collection point to the CASEVAC primary and alternate helicopter landing zones. Use combat route-clearance techniques to clear the ground CASEVAC route. Reduce or bypass obstacles created by "junk vehicles," CONEXs, rubble, etc. If bypassing is part of the plan, make it a branch to the plan and include decision points and conditions.

Precombat Inspections. Inspect MICLIC and tank-mounted countermine equipment. Ensure that designated dismounted sappers have at least 20 blocks of TNT or C4 and 500 feet of detonating cord to reduce a 100-meter-deep "lane" for vehicles.

Inspect mine detectors carried by engineers designated to execute this mission. Sandbag one vehicle to use for proofing vehicle lanes, and dismount all passengers when proofing the lane. Ballast load additional lane-marking material on vehicles. To assist the maneuver force in locating the correct lane to support their tactical plan, ensure that markings for multiple lanes are easily distinguished by day and at night. CASEVAC lanes must have a dedicated TCP. One technique is for this post to be initially manned by repre-sentatives from the medical platoon of the lead task force. Integrate a tank-mounted plow or properly prepared heavy vehicle (dozer, loader, or 5-ton truck with winch) into the plan to reduce rubble or junk vehicle obstacles.

Rehearsals. A combined-arms breaching rehearsal is required according to FM 90-13-1. This rehearsal will serve as the final check for mission-essential equipment and final adjustments to the plan based on PCIs. Synchronize the establishment of support-by-fire positions to isolate reduction sites and trigger conditions for initiating reduction operations (the conditions and who makes the decision). Determine who shifts obscuration and suppressive fires and when they are shifted. Leaders must rehearse handing over lanes to follow-on forces. Rehearse time-phasing the ground CASEVAC route clearance to helicopter landing zones and ambulance exchange points. Construct the unit's standard lane-marking system and route signs at the rehearsal site.

Countermobility Planning Considerations

Address these issues in the brigade-, battalion-, and company-level rehearsals. Plan to issue a scatterable mine warning (SCATMINWARN) to prevent fratricide.

Tactical Employment of Scatterable Mines

The S3, engineer and FSO should plan, in detail, the employment of artillery-delivered antipersonnel mines/remote antiarmor mines (ADAMs/RAAMs) and Multiple-Delivery Mine Systems (Volcanos). Specify the target to be attacked, a tentative location, its effect (disrupt, turn, fix, or block), the delivery system, the observer, and the trigger. To reduce fratricide risk, the scatterable mine execution plan must be clearly understood by leaders of mounted elements.

Protective Employment of Scatterable Mines

Ballast load the Modular Pack Mine System (MOPMS) on vehicles moving into objective area blocking positions. Consider sling-loading the MOPMS, conventional mines, and limited barrier materials to support transitioning to the defense and blocking enemy counterattacks.

Engagement Area Development

Specify the engagement area to interdict the enemy counterattack force. Ensure that battalion and brigade reserve forces have specified routes to move to the engagement area. Engineers may not be available to emplace obstacles, so specify the engagement area development tasks, including obstacle emplacement and fire integration, to maneuver units.

Survivability Planning Considerations

Perform this work concurrently with initia reconnaissance and "condition setting" by the brigade to support the brigade and division deception plans.

Field Artillery

Determine positioning areas and plan counterfire radars and ammunition.

Forward Area Refuel Point

Establish locations for stocking fuel and ammunition. Plan for multiple refueling sites to support the attack and lift aviation simultaneously.

Advance Trauma Lifesaving Sites

Locate forward treatment facilities and ingress/egress routes. The implied task is to establish helicopter landing zones for these sites.

Summary

While the process for planning engineer support to a MOUT attack follows existing decision-making steps, engineer planners must understand how this diverse terrain impacts engineer operations. Critical points include the following:

- ☐ Structures become key terrain.
- ☐ Belowground and multilayered aboveground dimensions are added.
- ☐ Terrain enhances the enemy's countermobility and survivability efforts and increases the friendly force's mobility requirements.
- ☐ Decentralized execution—while staying collectively synchronized—is required.
- ☐ MOUT-specific PCCs, PCIs, and rehearsals must be conducted.

By accounting for these impacts, engineer planners can make sound decisions to set the stage for effective engineer support to the maneuver force in this demanding environment.

Captain DeJarnette (now a major) was an engineer observer/controller at the Joint Readiness Training Center, Fort Polk, Louisiana, at the time this article was written. He is currently serving as a plans officer for U.S. Forces Korea Strategy and Policy. MAJ DeJarnette is a gradnate of the Command and General Staff College and the School of Advanced Military Studies, Fort Leavenworth, Kansas.

DOCTRINAL CHANGES IN URBAN OPERATIONS

By Lieutenant Colonel Anthony C. Funkhouser and Major Janet L. Kirkton

Captain DeJarnette's article, "Planning Engineer Support for an Urban Attack," published in 1998 (see page 4), is a great primer to realize the significant doctrinal changes that have occurred since then and to stimulate thought on future operations within urban terrain. Most significant is the change in the operational environment. This article was written based on the premise that we would fight a peer competitor in a conventional manner. Most would agree that this is no longer a valid and/or necessary assumption. Second, doctrine at that time supported breaching obstacles by launching mine-clearing line charges (MICLICs) down streets, without consideration for civilians and collateral damage. Although a technique, this would probably not be the technique of choice today, especially with the prevalence of blast-resistant mines.

Recent combat experiences in Chechnya, Israel, and Afghanistan reveal a trend that contemporary adversaries will no longer directly confront our Army. Instead, they have developed new ambush techniques that reduce our Army's technological advantages, especially within the urban environment. Additionally, the political environment has changed. In most cases, destroying cities to get to the threat is no longer accepted by the free world. Based on these developments, the joint community and Army have published new doctrine on the conduct of military operations on urbanized terrain (MOUT), specifically JP 3-06, *Doctrine for Joint Urban Operations*; FM 3-06 (DRAG), *Urban Operations;* and FM 3-06.11, *Combined Arms Operations in Urban Terrain.*

Emerging doctrine in FM 3-06 takes into consideration the contemporary operational environment. It also establishes a new framework for commanders to visualize, describe, and direct urban operations. This new doctrine focuses on understanding the terrain, society, and infrastructure. The doctrine looks to minimize collateral damage and preserve critical infrastructure. Engineers must understand the political end state of the operation, because it impacts how we conduct military operations. If the end state seeks only to remove certain focused individuals and reestablish the government and infrastructure, then destroying certain utilities and negatively affecting the population may not achieve the desired end state.

As a departure from the article, today's adversaries do not emplace conventional minefields, instead they use individual mines with small ambush teams. Mines are not just placed on the horizontal plane; they now have side and top attack capabilities that are command-detonated. This offensive capability significantly affects future engineer operations in urban terrain. In addition, adversaries have realized our vulnerabilities and expanded their use of booby traps and improvised explosive devices (IEDs) to counter our detection and neutralization efforts.

Captain DeJarnette's article is a great means to see the impact of emerging doctrine on the military decision-making process and in execution. With the unconventional use of mines, IEDs, booby traps, vertical obstructions, limited straight-line distances and restrictions on collateral damage, tactics, techniques, and procedures (TTP) that used to be commonplace will most likely not be effective within a large city. As a result, engineer commanders will be challenged to establish an accurate situation template and task-organize the appropriate countermine equipment. There is not one piece of engineer equipment that can detect and neutralize all types of threats, so extreme thought must be used to properly resource subordinate engineer units. If breaching is required, new TTP integrating sappers, explosive ordnance disposal detachments, mine-detection dogs, and heavy route-clearance assets—such as rollers or Panthers—will have to be developed.

In summary, Captain DeJarnette's article was a well-written article that fully explored the engineer challenges of the urban environment at that time. However, the world has changed, and new doctrine will affect how we approach solutions to the problems. We challenge you to reread Captain DeJarnette's article after you read the emerging doctrine and reflect on solutions for combat engineering in urban terrain.

Lieutenant Colonel Funkhouser is the chief of the Doctrine Development Division, U.S. Army Engineer School, Fort Leonard Wood, Missouri. In that capacity, he recently spent three months with the Battle Command Training Program-Operations Group F, specializing in urban operations. He also participated in the United States-Israeli Urban Operations Work Group, in Tel Aviv, Israel.

Major Kirkton is the deputy chief, Doctrine Development Division, U.S. Army Engineer School, Fort Leonard Wood, Missouri.

Light Engineer Lessons Learned in the Contemporary Operational Environment

By Captain Philip J. Dacunto and Captain (Bo) Arnold

While executing combat operations after a sudden deployment to Southwest Asia, light sappers of the 41st Engineer Battalion, 10th Mountain Division, Fort Drum, New York, gave new meaning to the motto *Essayons*. Operating first in Uzbekistan and then in Afghanistan, the light engineers performed numerous construction and area clearance missions for which they had never trained. Their combat successes can only be attributed to their versatility and ingenuity, especially when tools and training for certain uncommon tasks were lacking.

Deployment

Task Force 1-87 Infantry assumed the division ready force mission on the day before the 11 September 2001 terrorist attacks on New York City and Washington, D.C. Alpha Company, 41st Engineer Battalion, provided habitual support to the task force with a light engineer platoon. Consisting of three 8-man sapper squads and a 3-man platoon headquarters, the engineer platoon was trained in customary mobility, countermobility, and survivability support to a light infantry battalion task force.

On 20 September, the task force was assigned an emergency readiness deployment exercise (EDRE), designed presumably to further prepare it for responsibilities as the division ready force. The entire task force underwent routine checks to ensure that each soldier was ready for deployment with regard to medical, legal, and financial requirements. The sappers then requalified on individual weapons and loaded their prepacked personal, squad, and platoon equipment. This included palletization of equipment and bags and U.S. Air Force joint inspection of equipment and vehicles. The EDRE followed standard routines until the task force members received new chemical overgarments, body armor, and desert camouflage uniforms. It was now clear that this was more than just another training exercise.

Learning that their squad vehicles were an extremely low priority for air movement, the sappers refined packing lists and palletized almost all of their equipment, along with Class IV supplies for constructing protective wire and fighting positions at the destination, wherever that might be.

On 2 October, the first elements of Task Force 1-87 Infantry repositioned to Fort Drum's rapid-deployment facility to load

Engineer soldiers construct a roadblock.

aircraft for their final, classified destination. In the next few days, remaining elements of the task force continued this flow through the rapid-deployment facility until all had deployed.

Uzbekistan

On 5 October, the sapper platoon leader awoke on a dusty air base in Uzbekistan, with only 50 other Americans within thousands of miles. During the days that followed, his squads arrived with their supported infantry companies.

As anticipated, initial sapper missions included countermobility (wire and obstacles) on the perimeter and survivability within the base camp. However, the requested dig asset package of two small emplacement excavators (SEEs) and one D7 bulldozer had not been high enough on the airflow priority to make it into country. Relying exclusively on hand tools, sapper productivity was severely limited. After two weeks, a loader and a SEE arrived with a logistics task force, but the light engineers could only borrow the equipment for limited periods of time. Nonetheless, within 30 days, the small platoon emplaced more than 8,500 meters of defensive wire around the air base and eventually built more than 40 fighting positions and bunkers.

Task Force 1-87 Infantry relied on the sappers for construction as well. Although they were neither formally trained nor equipped for vertical construction missions, the sappers were initially the only engineers in the area and were assigned all types of engineer missions. While at the air base, the platoon built a tactical operations center inside a hardened aircraft shelter, numerous tent platforms, four guard shelters, and a detainee facility. In addition to carpentry skills, the platoon often used the welding skills of some of its soldiers.

Afghanistan

As the Afghanistan Northern Alliance's operational successes changed the strategic situation, the task force prepared for another deployment and new missions. Moving forward with their habitually associated infantry companies, sappers cleared land and developed bases at several bare-bones airfields in Afghanistan. With an estimate of more than eight million mines emplaced within Afghanistan's borders and minimal marking or recording of their locations, the risk to forces operating there was extreme. In addition, there was a significant risk of unexploded ordnance (UXO) left over from more than a decade of war.

Clearing areas for force bed down soon became a concern at the operating bases, as the new units that were arriving needed lodgment areas faster than engineers could clear them. Around Baghram Air Base, which became a major U.S. and coalition force forward operating base, all areas had a high risk of mines and UXO and had to be thoroughly cleared before use. Through coordination with local Northern Alliance commanders, sappers began by mapping out the locations of the minefield using laser range finders and Global Positioning System (GPS) coordinates. Then they prioritized clearance requirements and began clearing with their limited assets.

Engineers construct a guard checkpoint.

The sappers soon found that their organic AN/PSS-12 mine detectors were of minimal value because of the large amounts of metal scraps and other detritus left in the ground from earlier fighting. Fortunately, a coalition Army unit at Baghram was equipped with a medium-sized Aardvark flail, which could be used to clear and proof selected areas. While progress was slow and communications with the foreign soldiers sometimes difficult, the platoon was able to clear several areas for base camp construction and airfield improvements.

After the Aardvark departed, the sappers relied exclusively on miniflails, but this equipment cleared at a very slow rate. Also available for area clearance—from B Company, 92d Engineer Battalion—was one D7 dozer fitted with a mine-clearing armor-protection (MCAP) kit that provided protection for the operator. This MCAP dozer allowed safe clearance of larger areas.

Concurrently with land clearing, the light sappers performed construction missions as well. Initially, the only other engineer unit at Baghram was a platoon from the 92d Engineer Battalion,

The MCAP dozer with operators from B Company, 92d Engineer Battalion

Engineer soldiers weld a gate at Baghram.

but this superb vertical construction unit was a limited asset with a long list of tasks. Thus, the smaller jobs—especially those related to survivability and countermobility—fell to light sappers. In addition to emplacing thousands of meters of wire during a two-month period at Baghram, the sappers built or assisted with two detainee facilities and several guard checkpoints, installed doors and windows in a guard building, constructed improvised Hesco bastions for use at entry control points, welded gates and drop arms, and completed a wide variety of other tasks. They borrowed tools and employed more and more carpentry and welding skills.

In a couple of months, other engineer units arrived at Baghram to augment the base's construction and mine-clearing capabilities. Included were a U.S. Air Force Rapid Engineer-Deployable, Heavy-Operations Repair Squadron—Engineer (RED HORSE) team and coalition assets such as a general-purpose engineer platoon, runway repair experts, and a mine-clearing detachment.

Operation Anaconda

In late February 2002, light sappers again showed their mettle in direct combat operations. Headquarters, 10th Mountain Division, initially designated as Coalition Forces Land Component Command–Forward (CFLCC–FWD), had moved into Baghram, redesignated as Coalition Joint Task Force–Mountain (CJTF–MTN), and assumed control of all conventional and special operations forces in Afghanistan. Additionally, CJTF–MTN began planning for what would eventually become Operation Anaconda, to eliminate a pocket of Al-Qaeda and Taliban forces in an area of the Paktia Province.

Task Force 1-87 Infantry's mission was to establish positions to block Al-Qaeda and Taliban troops fleeing the area after a concurrent attack by Afghan military forces. On 2 March—and under 3d Brigade, 101st Airborne Division command—the task force conducted an air assault into several landing zones. Although initially rebuffed by intense enemy activity at one landing zone, the task force successfully inserted and conducted continuous operations over the next nine days along a ridgeline at elevations between 8,000 and 10,000 feet—possibly the highest elevations at which the U.S. Army has ever conducted combat operations. The task force routed out enemy forces that had not yet withdrawn and destroyed caches and caves.

The task force commander attached a squad of light sappers to each infantry company with the platoon leader and platoon sergeant integrated into the battalion command posts, thus providing maximum flexibility and capabilities for the maneuver commanders. This close attachment proved essential because the rugged, high terrain made it impossible for sappers to move quickly between separated maneuver units. During planning, sappers focused on mobility and countermobility tasks, preparing to breach lanes through minefields and create obstacles at the blocking positions. During Operation Anaconda, however, sappers focused mainly on cache destruction. They made maximum use of their demolition skills, destroying caches of rocket-propelled grenades, recoilless rifles, small arms, mines, and even several howitzers, with only the demolitions that they carried on their backs. This often called for innovation, as they used limited demolitions to destroy the maximum amount of enemy equipment. For example, the sappers disabled the captured howitzers using claymore mines to augment the remaining two blocks of C4 demolition at that location.

Some of the limitations during Operation Anaconda were the weight of the soldiers' loads and the limited availability of resupply. Although leaders revised packing lists carefully to minimize excess after the initial insertion, soldiers learned that they had to pare down even more. They could not move and fight at the extreme altitudes while carrying even a modest rucksack load. Officers and NCOs ensured that their soldiers used a minimum of the most effective clothing to combat the freezing temperatures. They left behind all cotton items—even their desert camouflage uniforms—for a uniform of polypropylene and Goretex. To help lighten the load, some units deployed without sleeping bags, which were delivered a day or two later. Load limitations were particularly challenging for sappers, who brought only the most essential tools for their mobility and countermobility tasks. Planned obstacles relied on the innovative use of limited demolitions, and some materials—such as those for lane marking—had to be kept to an absolute minimum. Sappers relied almost exclusively on C4, leaving heavy bangalore torpedoes, cratering charges, and shaped charges back at Baghram, ready to be pushed forward should they be needed.

Lessons Learned

The light engineer platoon learned several important lessons from its deployment to Southwest Asia, which fall into three categories: deployment readiness, sapper tools, and sapper training.

Deployment Readiness

Don't reinforce one platoon too heavily at the expense of others for any operation. This is important whether the deployment is to the Joint Readiness Training Center or if it is an operational deployment. In our case, the priority of company personnel and equipment supported another platoon's impending rotation to Kosovo. As a result, our platoon deployed with only 21 of the 27 soldiers it was authorized, and it had more pronounced supply shortages than it might otherwise have had. This made the short period following the EDRE that much more difficult as leaders throughout the company sought to cross-level yet again.

Light engineer squads should not become too reliant on their vehicles. Modern deployments are usually made by air, and there is seldom enough space for all the authorized equipment. In our case, space was allocated for only one high-mobility, multipurpose, wheeled vehicle (HMMWV), so load plans designed for squad vehicles were not useful, and most squad equipment was palletized. In addition, sappers had to use their rucksacks to carry demolitions, breach kits, and other critical tools. Thus, it is important to have load plans with and without squad vehicles.

A survivability package of two SEEs and a D7 dozer should be on call for the division ready force engineer platoon. This package, assembled after our alert, was not assigned a high enough priority to make it into the airflow. The equipment would have dramatically increased countermobility and survivability capabilities, especially with the wide variety of pneumatic tools on the SEE. The light sappers used mostly hand tools to dig survivability positions and emplace wire to protect the airhead.

Sapper Tools

A pneumatic picket pounder attachment should be included with the SEE for deployments. The platoon emplaced more than 8,500 meters of wire for survivability positions and

An engineer clears an area with a miniflail.

obstacles in Uzbekistan. The attachment could have been palletized with minimal impact to aircraft space and would have greatly improved productivity.

Light sappers need to deploy with organic carpentry tools. Since light sappers were the first engineers on the ground in Uzbekistan, and construction engineers did not arrive for another month, many tasks normally assigned to vertical construction engineers fell to the light sappers. While their skills were adequate for the rudimentary construction jobs assigned, they had no carpentry tools. At a minimum, a power saw, power drill, hand saw, hand drill, and hammers should be procured locally, if necessary, and deployed whenever base development tasks may be assigned. Perhaps these common carpentry tools should be added to the light engineer squad tool sets. Larger equipment that would be very useful includes a reciprocating saw, hammer drill, small arc welder, and gas-powered cutter with a carbide blade. In addition, a small generator for the power tools would prevent the sappers from having to borrow power from other sources. These should either be deployed with the leading sapper unit or palletized for call forward. Again, perhaps these should be added to the platoon or company headquarters modified table of organization and equipment.

Detection tools incorporating ground-penetrating radar, such as the Handheld Standoff Mine-Detection System (HSTAMIDS), would be extremely helpful in augmenting existing or improved metal detectors (for example, the AN/PSS-12 and F1A4 Minelab).

A team of mine-detection dogs with handlers should be available to any deployed light sapper battalion facing significant mine-clearing missions. Mine-detection dogs were invaluable at Baghram, especially for proofing areas for mines and UXO. Dogs frequently found UXO in areas that were surface-swept, flailed, and scraped by both an MCAP dozer and a grader!

The sapper platoon needs a medium-sized flail, about the size of a HMMWV, that is deployable by C-130. The miniflail was helpful in proofing small areas, but it had serious maintenance problems and lacked the necessary power. Scraps of metal and uneven terrain defeated it, and because of its small width, it was unsuited for clearing large areas. A mid-sized foreign flail, the Hydrema, was extremely effective and cleared large areas at Baghram, but its size and weight would be a limitation for strategic deployment. Clearly, these additional mine-clearing assets need not be organic to every light engineer company. However, they should exist somewhere in the force structure and be attached to deploying units whenever minefield/UXO clearance is likely to be a significant task.

Sapper Training

Sappers must be able to clear large areas for base camps and assembly areas. The light sappers' capabilities in this area are weak, primarily because platoon tasks and company mission-essential task lists usually do not address area clearance for operational purposes. Instead, training most often focuses on breaching and bypassing. In reality, today's operational environment includes not just carefully laid obstacles in specific locations but often huge areas littered with mines and UXO.

Sappers need to be trained to defeat or reduce mines in a variety of ways. When confronted with mines, sappers are well-trained to either destroy them in place or bypass them. However, traditional destruction of mines with demolitions endangers nearby personnel and equipment and spreads explosive residue around, reducing the subsequent effectiveness of mine-detection dogs in that area. Sappers must be well-versed in the use of available flails, but we believe that more importantly, they must be experts in identifying and defusing most types of foreign mines. At a minimum, they should understand the design and attributes common to sets of mines that can contribute to inferences about other types of mines not previously studied. Mine instruction should also include disarming and defusing them so they can be removed safely and negate the requirement for explosive disposal. A rudimentary knowledge in identification of UXO is essential as well. Explosive ordnance disposal (EOD) assets are extremely limited, and when sappers are clearing areas, they are just as likely to find UXO as mines. Once UXO is found, engineers should still rely on EOD personnel to clear it.

Since it would be an impossible training challenge to bring all sappers up to these standards, one way to achieve a limited capability would be to train some trainers—perhaps one NCO per sapper squad—in a "master countermine course." Once trained, these sergeants would be certified as master countermine trainers. They would return to their home station and teach other members of their squads to clear areas for operational use, in addition to breaching and marking bypasses.

Conclusion

While the brown hills and dust of Uzbekistan and Afghanistan are now a fading memory for our company, other light sappers may deploy to another bare operational base in a mine- and UXO-littered area in the future. Therefore, all light engineers should benefit from these lessons learned and try to improve engineer tools and training. Such improvements, coupled with the *Essayons* spirit, will ensure accomplishment of the challenging light sapper missions ahead.

Captain Dacunto was the company commander who trained, deployed, and supported the sapper platoon. He concurrently served for three months in Afghanistan as the assistant division engineer in Headquarters, 10th Mountain Division.

Captain Arnold served as platoon leader through-out the six-month deployment. He was awarded a Bronze Star for meritorious achievement for his actions during the deployment and during Operation Anaconda.

QA/QC Construction Supervision . . . or "Just Wing It"

By Major Jeffrey J. Johnson

Quality assurance (QA) and quality control (QC) are two of the most important elements of any engineer construction project. However, QA/QC have not been officially proclaimed a part of the engineering process, and there is a trend among the junior officers and noncommissioned officers (NCOs) throughout the services to not employ the conceptual practices of QC. Additionally, senior leaders in the battalions and squadrons are not mentoring and developing a solid QA program within their organizations that ensures the success of the project and the service members involved in the construction.

The unit is responsible for maintaining construction standards as outlined in the design specifications, plans, and other standard engineering documents. How is this guaranteed? Supervision. Why is it important? There are many obvious reasons: safety; savings in time and materials; superior product or outcome; service member satisfaction and reduced frustration; training in organization, management, and construction techniques; unit reputation; and mission accomplishment. In other words, QA/QC provide a little more predictability in an often-unpredictable profession. Figure 1 shows improper bracing and construction of forms.

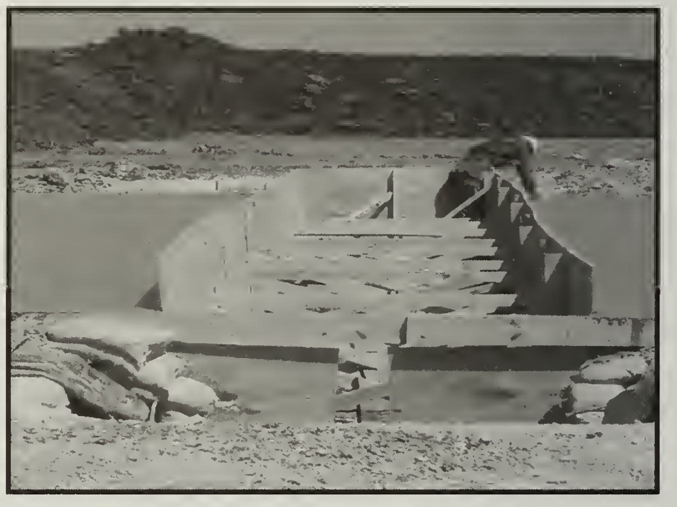


Figure 1. These forms were poorly constructed and not inspected. Notice the blowing and waving effect.

Engineering Process

Thousands of military engineers are trained in the engineering process annually at our formal schools. This process involves six fundamental elements: project management, planning, design, construction, operations/maintenance, and disposal. All six elements exist in almost any engineering undertaking. So which element does QA/QC fall under? None, some, or all? Up until now, not once during that formal school experience in the military was the phrase "QA/QC" emphasized, nor did students receive a block of instruction on how to set up a QA/QC program and implement it on a construction project. It's possible that it was camouflaged in the title of "leadership" or cloaked somewhere in the project management block of construction. Yet, as a company grade officer and the officer in charge (OIC) of many projects, I often found myself figuring things out through "on-the-job training"—and many of the problems were related to QA/QC.

Units from all services execute various types of projects (from simple to very technical) and implement their own concept of a QC program. Some of the programs are very good, but some are almost nonexistent. The quality of the program depends partly on the leadership, but a lot also has to do with the lack of formal instruction on the QA/QC process. It is a refined skill and program that needs to be taught as well as learned.

QC Recommendations

The project OIC needs to be concerned with the QC of the project, which can be broken into a phased control method. The complete performance of the control phases is the unit's responsibility, not the customer's or any third party's (such as outside contractors, material procurement representatives, or inspectors). The role of the S3 shop is to ensure that the control phases are performed thoroughly, in a timely manner, and by knowledgeable, unit-designated QC staff. Enforcing an existing unit SOP is always a good method. If there is no SOP, the U.S. Army Corps of Engineers implements a QC concept consisting of four phases: [1]

Preparatory Phase

This phase begins with actions in advance of construction. A few examples are reviews of designs, details, specifications, test reports, and mix designs; a physical check of material on-site against approvals and customer requirements; safety checks of equipment; and other preparatory steps that depend on the particular operation. This phase is active from the start of planning to the initiation of construction.

Initial Phase

This is the time for the unit, customer, and any third party to ensure or reestablish standards of workmanship. If there are differences of opinion on the interpretation of construction requirements, the issue can be discussed and settled at the outset of work rather than after the work is in place. The initial inspection phase is a practical method of performing preventive inspection and reaching agreements (in writing) in advance. Proper coordination from the unit must be made before construction starts and during the initial phase. This is to ensure that construction techniques meet specifications and the intent of the designer and that tests are identified.

Follow-Up Phase

This phase includes inspections and testing to determine continuation of compliance and workmanship established during the preparatory and initial phases. Follow-up inspections may occur on a daily, routine, or predetermined basis as required to ensure strict construction compliance (see Figure 2). This happens throughout the project. For example, units can construct "mock-ups"—such as sample footings, walls (masonry or lumber), and trusses—to establish standards or have inspectors approve the mock-ups before constructing the proportionate load of the project. Figure 3, page 18, shows a county inspector conducting a slump test on a grout fill for a concrete masonry unit (CMU) wall.

Completion Phase

When a segment of work or a project is near completion, the unit should carefully examine this work and prepare a list (called a punch list) of anything that is not completed or that does not conform to design/customer requirements. Prefinal and final inspections should be conducted by the customer, unit, and third parties about a week before the project is completed and turned over to the customer. This will ensure that all items are identified on the list and that the customer is satisfied.

Everyone in the unit—from commanders down to the junior NCOs—can make a big difference in the QC system by implementing daily meetings and establishing a team-building/project-ownership concept into the mission. First, daily meetings help the unit prepare for future tasks, identify possible material or equipment problems, recognize QC tests or measurements, and organize for the next day's operations (possibly for a week, if feasible). For instance, a platoon

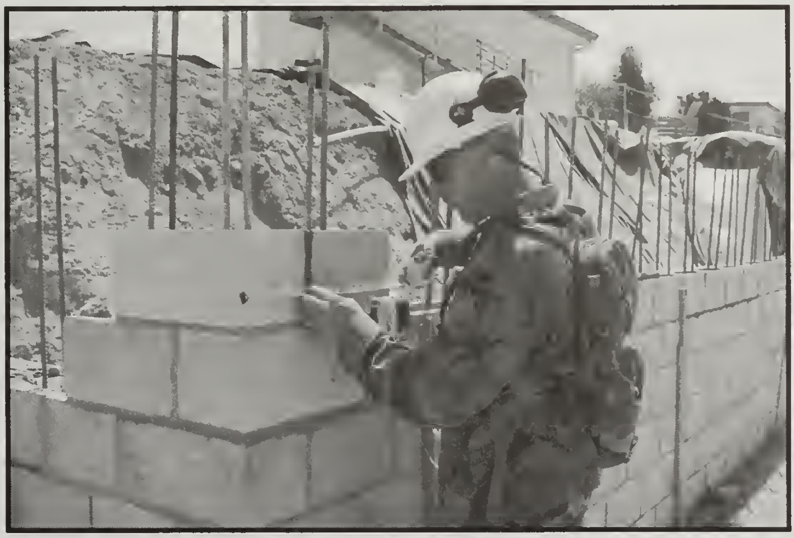


Figure 2. This QC NCO ensures that the CMU wall and block are properly located and measured/cut for placement.

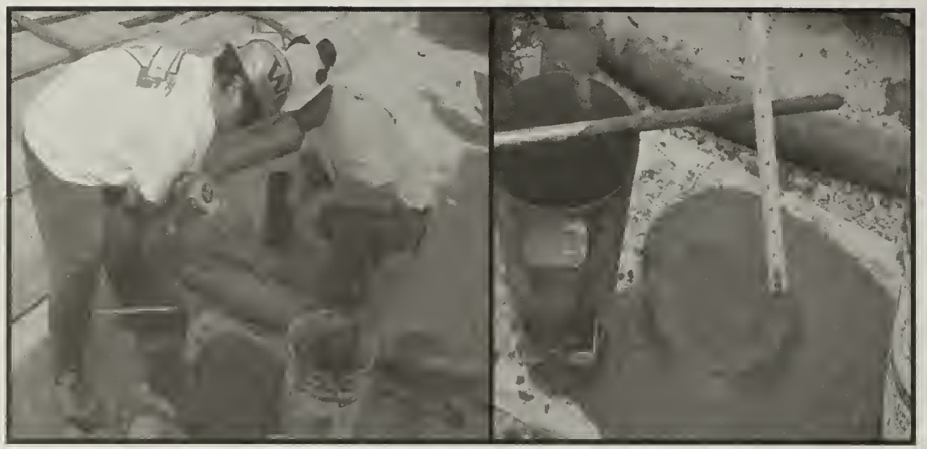


Figure 3. County inspectors assist the unit QC representative in conducting a "slump" test for a grout fill on a CMU block wall. The slump was to be about 8 inches.

preparing for a large concrete placement on a project can conduct daily meetings, which can help monitor and define the materials required (on-hand/shortfall), the equipment needed (such as vibrators, screed, a power trough, floats, and a pump truck), the personnel responsibilities and duties in support of that task, mandatory testing (such as slum or cylinder), deliveries, start and stop times, and on and on. This can be done for each task or subtask, using the critical path method of evaluation.

Second, explain the process, methods, and techniques to the most junior service members so they will understand the duties involved in concrete placement. This will help them appreciate what they are doing and why. It will also develop a sense of accountability for the workmanship quality. It should parallel the same actions taken by an infantry unit preparing for a patrol: inspections, briefs, sand table exercises, rock drills, and rehearsals.

Lessons Learned

Many lessons are learned on each project, and no project is ever the same as the last one. But there are a few consistent slipups that can mean the difference between quality workmanship and poor workmanship on any project.

Units seem to wrestle against developing a QC notebook that contains all daily QC reports, tests, and measurements. This notebook helps the project OIC or senior NCO formally document many things. It can help track deficiencies in materials and trends in production (positive or negative); document corrective actions; identify positions of assigned personnel, equipment usage, and tests or measurements conducted; and help maintain those reports in a neat and orderly fashion.

For example, a unit was placing several hundred yards of concrete for the foundation of a simunitions facility in North Bronx, New York. A few days after the placement, the customer requested documentation of the slump tests conducted on each batch of concrete delivered. The unit could provide only two handwritten documents on the entire placement (more than 12 truckloads), because the test results were either never documented or were lost. The unit was very close to hammering out the entire placement and starting all over. This could have been prevented if a QC representative had been supervising the requirements and the paper trail of testing for that task.

Units fall short in identifying the control, inspection, and testing procedures—both on- and off-site—for each task and assigning these responsibilities to the QC staff. On one project, a unit was placing concrete and didn't have a slump test kit. The trucks were turned away, and the placement was delayed until they found a kit. QC supervision, which was missing during this installation, could have helped identify tests to be performed for each task and state who was responsible for the results and who should have prepared and signed reports.

Checking the designs, details, notes, specifications, checks, and measurements and ensuring that they match materials on hand are commonly overlooked until they affect the progress of the project. A unit that was constructing a facility in San Diego cut the rebar, bent it, and started placing it in the footers in preparation for the first placement of concrete. A county inspector failed the footings because specifications called for grade 60 rebar in about 90 percent of the foundation, but the unit had used grade 40. Figure 4 shows how rebar is marked and graded.

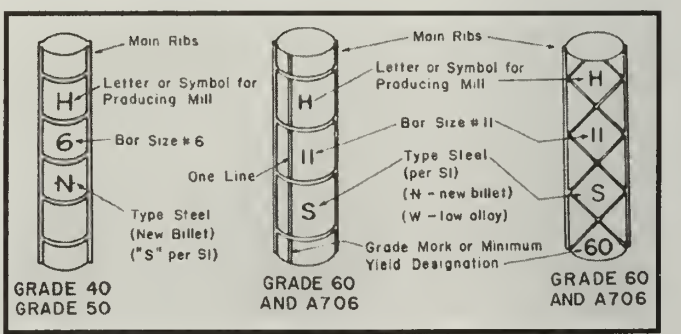

Main Ribs
Letter or Symbol for Producing Mill
H
6
Bar Size # 6
N
Type Steel (New Billet) ("S" per SI)
GRADE 40
GRADE 50
One Line
H
11
S
GRADE 60 AND A706
Main Ribs
Letter or Symbol for Producing Mill
Bar Size # 11
Type Steel (per SI) (N - new billet) (W - low alloy)
Grade Mark or Minimum Yield Designation
H
11
S
60
GRADE 60 AND A706

Figure 4. This is an example of the identification markings rolled onto the surface of reinforcing bars. The unit did not verify design specifications with the materials being used.

Constant QC oversight or supervision during the workday on tasks being performed is often sporadic. This causes a lot of problems with workmanship quality and construction techniques, which leads to many tasks being repeated. For example, one unit built, tore down, and rebuilt a concrete wall three times because it was not using proper masonry construction methods, and the wall consistently lost its bond and was out of plumb. Figure 5 shows a pilaster that was constructed incorrectly.

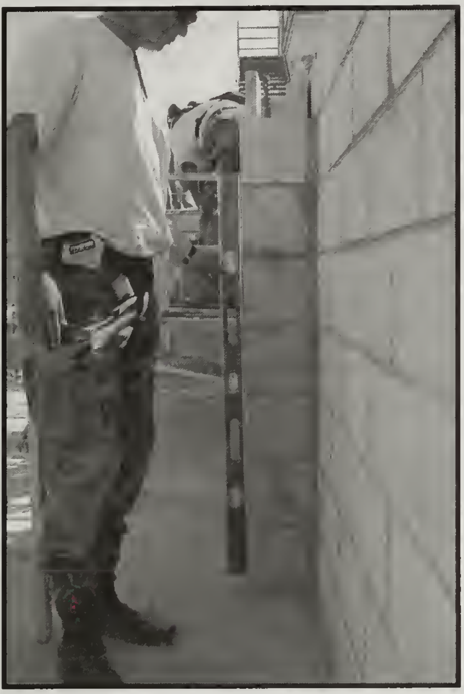


Figure 5. This pilaster is "out of plumb" by 1 1/4 inch on the seventh course, the second course CMU block is cut, and the mortar joints are sloppy.

QA Supervision

Now that a few control measures are in place, unit leaders must guarantee that QC actions are being followed through. As in troop-leading procedures, supervision is critical to the success of any mission. Therefore, QA becomes the final engineer troop-leading step on a construction project. This includes such things as inspections, intelligence updates (design changes or guidance), rehearsals (practicing essential tasks, revealing weaknesses, and improving understanding of the concept of operations at all levels), brief backs, rock/sand table drills, stick drills, site visits, meetings (daily/weekly/monthly after-action reviews), encouragement, motivation, mentorship, and participation. These are just a few effects that the leadership in a unit can bring to bear on a QC program and help set up young officers and NCOs for success. Figure 6 shows rebar with grease accidentally smeared on it. Adequate supervision could have prevented this problem.

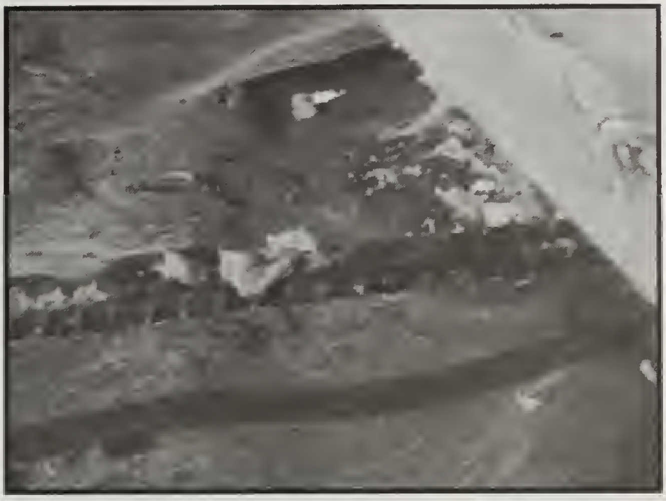


Figure 6. The grease on this rebar will not allow the concrete to adhere around the reinforcement as it should. More care should be taken when lubricating forms.

Summary

It is possible that a QA/QC program could evolve by itself if solid "Leadership 101" was exercised; however, there are many negative lessons learned on a construction project that could be avoided if units would implement a formal program (the unit's SOP). Often, junior troops are fixing, replacing, working harder, taking longer, and exercising poor construction habits because the QA/QC program on the site for that project is broken. Thus, those experiences are carried over into the next project or back in garrison with sour attitudes about the leadership and the service. Behaviors then become a reflection of that attitude, and ultimately unit *esprit de corps*, motivation, and workmanship decline. As leaders, we owe it to our troops, our superiors, and our customers to not "just wing it" but to exercise excellence in organization and program execution.

Endnote

[1] U.S. Army Corps of Engineers, Engineer Pamphlet 415-1-261, *Quality Assurance Representatives Guide*, Volumes 1-5, 1992.

Major Johnson, United States Marine Corps, is the engineer planner at Joint Task Force 6, Fort Bliss, Texas. Previously, he was a platoon and company commander, 3d Marine Division, 3d Combat Engineer Battalion, and a wing engineer officer and department OIC, 2d Marine Aircraft Wing, Marine Wing Support Squadron 27. Major Johnson is a graduate of the Marine Corps Engineer Officer Basic Course, the Army Engineer Officer Advanced Course, and the Marine Corps Command and General Staff College and holds a bachelor's in architectural technology from the University of Memphis. He will attend the Air Command and General Staff College in 2003.

Out Front With the Divisional Cavalry

By Captain Elliott J. Bird

Alpha Company, 44th Engineer Battalion, Camp Howze, Korea, habitually supports 4th Squadron, 7th Cavalry Regiment (4-7 Cavalry), in Korea. The opportunity is rare in the Engineer Corps, because divisional cavalry units do not usually have habitual engineer support. As a consequence, their offensive and defensive doctrine are not well integrated. The support that engineers provide on a consistent basis offers great combined-arms training. In providing support to 4-7 Cavalry, Alpha Company works outside of the rest of the 44th for all its combat operations. This article addresses many of the keys of the trade that can help in understanding the cavalry's mission and mindset and how task force engineers can best support it.

Cavalry Operations

The divisional cavalry squadron is usually out in front of the division providing security and/or reconnaissance. In essence, the squadron is the eyes and ears of the division and provides vital information that allows the division commander to make critical decisions on the battlefield. Cavalry operations can be broken into four subcategories as listed in FM 17-95, *Cavalry Operations*. They are reconnaissance, security, offense, and defense. As an engineer supporting these operations, it is essential to understand what they mean and the fundamentals involved. Of these operations, reconnaissance and security will be discussed.

The combined-arms team battle-tracks situation reports from the troops.

Reconnaissance Operations

Divisional cavalry squadrons perform area, route, and zone reconnaissance. The squadron or troop especially needs to use engineers on route reconnaissance operations. Cavalry squadrons and troops are trained on this task, but not to the level of expertise of the engineer platoon leader or company commander. Coordinating efforts and fully understanding the roles that the engineers and the squadron play on this mission help give better reconnaissance results. The squadron's mission for reconnaissance, in relation to the fundamentals of reconnaissance as stated in FM 17-95, is as follows:

- Maintain tempo and focus.
- Orient on the reconnaissance objective.
- Report all information rapidly and accurately.
- Retain freedom of maneuver.
- Gain and maintain enemy contact.
- Develop the situation rapidly.

The squadron is tasked to clear routes for follow-on forces from the division. It must maintain a fast tempo to allow the rest of the division with more firepower to move up the designated routes or recommend different routes. The engineer leader in this situation must understand the objective and ensure that the squadron does not get slowed down by obstacles. Ensuring that each troop has the capability to breach obstacles allows the squadron or troop to maintain the proper tempo and focus.

The squadron and engineer support must also remember to orient on the reconnaissance objective—usually form-fixed points on the battlefield. The temptation is to lose sight of the objective of clearing routes and to focus on the enemy. Engineers must not let the squadron become bogged down in heavy enemy contact, which is not the purpose of the recon. They must ensure that mobility corridors are open to the squadron.

In reporting information rapidly and accurately, engineers become key personnel. If a route is not passable by heavy vehicles or tanks, engineers must ensure that the situation is properly reported. All too often, a troop or squadron commander will decide if a route is passable to follow-on forces without engineer input. An incorrect assumption can impede an entire operation. The engineer leaders must readily determine the trafficability of routes.

The troop and squadron need engineers to give them freedom to maneuver. The squadron, which is usually up front, may be the first to come in contact with the enemy, and it maintains contact and develops the situation. All of these elements are necessary for engineers to understand. The squadron engineer in the tactical operations center (TOC) must plan alternate routes for the squadron to allow the troop commander the maneuver freedom he needs to accomplish the mission. The terrain analysis that engineers bring to bear on the situation is unparalleled. As they plan the routes, they ensure that troop commanders and engineer attachments understand the routes and purposes for them.

Once the squadron gains enemy contact, the focus of the engineer effort shifts to route accessibility and possible mobility problems. The squadron will continually maintain contact through air troops, but ground troops will rely on engineer planning to find the most accessible route that allows them to maintain contact.

As the squadron gains contact, it develops the situation, and the engineer effort becomes secondary. Depending on the situation, the engineers may plan for the squadron to continue to push forward offensively or to hand off the battle to follow-on units.

When engineers and the cavalry squadron use all of these fundamentals, they become a greater fighting team, accomplishing the necessary missions together.

Security Operations

Security operations for a cavalry squadron are usually based on executing a screening mission, which it frequently performs out in front of a brigade or division front. A screen line is nothing more than a defense in-depth that allows the squadron to trade ground for time and allows the division to properly prepare its defenses or reconsolidate its forces for future operations. To have an effective screen line, the squadron needs a good engineer plan that includes situational obstacles. Screening operations also use some basic security fundamentals:

- Orient on the main body.
- Perform continuous reconnaissance.
- Provide early and accurate warning.
- Provide reaction time and maneuver space.
- Maintain enemy contact.

When a cavalry squadron prepares a screen line, the squadron engineer must be directly linked into the planning process. To orient itself on the main body, it often calls on the engineer to coordinate with engineer units behind the screen line to find the emplaced obstacles and ensure that lanes are available for passage of lines. This allows the squadron commander accurate information on what the defense behind him looks like and how to establish his forces.

Soldiers from Alpha Company, 44th Engineer Battalion, work in the TOC, updating reports and tracking engineer effort on the battlefield.

Out in front, the squadron becomes the eyes and ears of the division, and the air troops continue to send in reports of enemy movement, which helps the division commander make decisions on the course of the battle. This continuous reconnaissance provides the early and accurate warning needed. The squadron engineer must have knowledge of all such spot reports so he can plan for situational obstacles.

The obstacles that are planned and put in are usually scatterable mines or quick obstacles to slow an enemy and provide the necessary reaction time and maneuver space. By slowing the enemy and integrating an effective obstacle plan to support the squadron's screen line, engineers help the squadron maintain combat power and fulfill its overriding mission as the eyes and ears of the division commander.

As discussed previously, once enemy contact is made, the squadron will strive to maintain contact. At this time, engineer effort becomes secondary to the squadron's battle. The engineer in the TOC must look ahead to the next course of action and provide necessary mobility planning for the squadron to accomplish.

Conclusion

It is important to remember the history of the cavalry, its great lineage, and its current mission. The division cavalry squadron moves fast and furiously on the modern battlefield. Its missions are different than any other unit, because it is not a normal maneuver battalion. Although its capabilities and diversity make it successful, with proper coordination and planning, engineers can facilitate the squadron's overall success.

Captain Bird was the executive officer, Alpha Company, 44th Engineer Battalion, and later the adjutant for the 44th. He will attend the Engineer Captain's Career Course at Fort Leonard Wood, Missouri, beginning in March 2003.

Using the Royal Building System in Theater Construction

By Captain Samuel Pickands

This article describes the Royal Building System (RBS) as used in the New Horizons 2002 exercises in Nicaragua and El Salvador. The intent of the article is not to summarize the New Horizons 2002 projects or evaluate exercise results but to present to the military engineering community lessons learned from using the RBS. This system is one of several similar construction systems available today.

As part of the Deputy Joint Chiefs of Staff-directed New Horizons exercise organized by the U.S. Southern Command, active duty and reserve engineers from all four services train by building public infrastructure and utilities throughout Central and South America. The arrangement has been ideal for creating and maintaining expertise in theater construction methods in U.S. Army engineering units, while providing needed infrastructure projects to our American neighbors.

New Horizons 2002 did not focus engineer training on the concrete masonry building materials typically used in theater construction. Instead, U.S. Army South (USARSO) elected to use the Canadian-developed RBS for vertical construction. In the Caribbean, civilian RBS buildings have withstood tropical storms that leveled their conventional neighbors, bolstering the vendor's claims that the resulting buildings are among the most survivable structures, even though they can be built relatively quickly.

The RBS uses vinyl wall forms constructed of 4-, 6-, or 8-inch-wide modular sections to create a single continuous "mold" of a building. Vertical steel reinforcing bars are fixed into an underlying concrete slab and interweave through this mold, and they are tied together by horizontal steel bars. Finally, concrete is poured into the formwork from above in "lifts" or layers. Once the concrete sets, the result is a reinforced-concrete building with a colored vinyl covering.

The potential uses of these rapidly built reinforced-concrete buildings are obvious. Buildings that can be built quickly yet are well insulated, relatively soundproof, and resistant to blast damage, fires, and small-arms fire have many applications in semipermanent forward installations.

Designs for the project buildings were supplied to the task force by USARSO, and the vendor used the designs to project a bill of materials (BOM) for each site and supply the correct components. U.S. Army reservists from the 389th Engineer Battalion (Iowa), Marine reservists from the 6th Engineer Support Battalion, and active duty sailors from the 4th Naval Mobile Construction Battalion (Seabees) were all assigned RBS projects. None of the units had prior experience with the system, and both Marine and Army construction crews rotated out every two weeks, leaving only a handful of cadre for the duration of the exercise.

The New Horizons environment in Central America was ideal for testing the RBS. The tropical heat and limited infrastructure of the host nations mirrored the challenging conditions in forward-deployed operations. The reinforced-concrete buildings produced are also sure to be appreciated in the region where earthquakes and extreme weather are the norm.

In general, RBS wall forms were simple to use and suitable for military construction, even with untrained crews. Like any system, however, many lessons were learned from the first use of the RBS. If your unit has an opportunity to build with the RBS, you will profit by incorporating these lessons learned during your training, engineering, and logistics planning.

Assembly and Training

Building walls with the RBS is theoretically much faster than building with concrete masonry units (CMUs). Under ideal conditions (expert crews familiar with the RBS, good weather, horizontal work complete, all equipment and parts available, and long workdays) RBS structures can be built in 72 hours. These examples, however, are not useful for military planning, since they fail to account for the military realities of personnel rotation, confusion of site BOMs in shipment, remote worksites, BOM shortages, formwork adaptations to extreme climates, heat category work-rate limitations, time lost to force protection measures, local vendor delays, and utility connection delays.

When planning, leaders must also remember that the RBS is primarily a wall system. With trained leadership, wall construction may be faster with the RBS, but horizontal work and slab preparation are virtually identical to CMU construction. Roofing, utilities, doors and windows, and internal finishing are somewhat faster with the RBS, but at least initially, even these advantages will be offset by the unfamiliarity of the system. If your unit is not experienced at horizontal, utilities, roofing, and finishing work, your worksite progress will be slow, whether or not you use the RBS correctly.

In the final analysis, *RBS wall construction is not faster than CMU construction unless and until the worksite leadership has experience with the system.* Fortunately, the learning curve with the RBS is very steep, and a small number of trained cadre can shorten construction time even with untrained crews. For example, Task Force Oxelotlan needed 10 days to install the wall forms and pour the concrete at its first project, the San Marcos Lempas School in El Salvador. However, after the cadre had become familiar with the RBS, the task force was able to use two trained NCOs and an untrained multinational construction crew to install rebar forms and pour the walls in just 6 days for the Zamoran School. An even steeper learning curve can be seen in the overall project durations—the San Marcos Lempas School took 80 days to complete, whereas the Zamoran School took just 41 days.

Concrete Slab

The basis of all RBS structures is a concrete slab. Monolithic slabs were used in El Salvador; however, nothing about the RBS restricts the use of floating slabs instead. A unit that can build a slab for a CMU structure can also build one for the RBS.

First, unless the plans have already taken expansion into account, slabs must be slightly oversized to account for the predictable expansion of the wall forms in hot environments. If the slab is not oversized, the walls may overhang the edges of the slab by as much as an inch at points. Oversizing ensures that the walls are completely supported by the slabs and creates a professional appearance.

Soldiers brace the wall of the Zamoran School.

Slab and rebar for the Lempas project

The vertical rebar that will weave through the vinyl wall forms may be placed in the slab while the concrete is still wet. However, if the concrete is allowed to set (and concrete sets quickly in hot climates), engineers will need to drill holes for the rebar instead. To do this, units must be prepared with powerful (preferably pneumatic) drills and have three bits for each drill. Examples of suitable drills are the pneumatic drills in the small emplacement excavator (SEE) vehicle basic issue items or the Marine Corps compressor-driven drill sets. To reduce wear on the drill bits (which are difficult to replace while deployed), the site crew must ensure that the metal reinforcing mesh is either set back from the edges of the slab or fixed so that that these vertical holes will not strike the mesh or reinforcing bar.

Form Distortion

The RBS forms were initially designed for use in Canada. They begin expanding once the ambient temperature exceeds 5°C or 41°F. The manufacturer has studied this expansion and can complete building drawings with this expansion taken into account if you provide the expected ambient temperature at the time of the pour. However, if you are using a standard military design drawing that does not account for form expansion in heat, use the formulas below to project how much larger your forms will be when assembled in a certain heat. Note that the following formulas are for 6-inch/150-millimeter panels. Different formulas are available for 4-inch/100-millimeter and 8-inch /200-millimeter panels.

Δ = overall change in length

L = planned length of wall being considered

T = ambient temperature at the expected pour time

If you are measuring length in meters and temperature in Celsius, use the following formula to determine the change in length in your wall given the temperature:

$$\Delta_{millimeters} = (((T_{Celsius} - 5)/15)) (L_{meters}))$$

If you are measuring length in feet and temperature in Fahrenheit, use this formula to predict your change in inches:

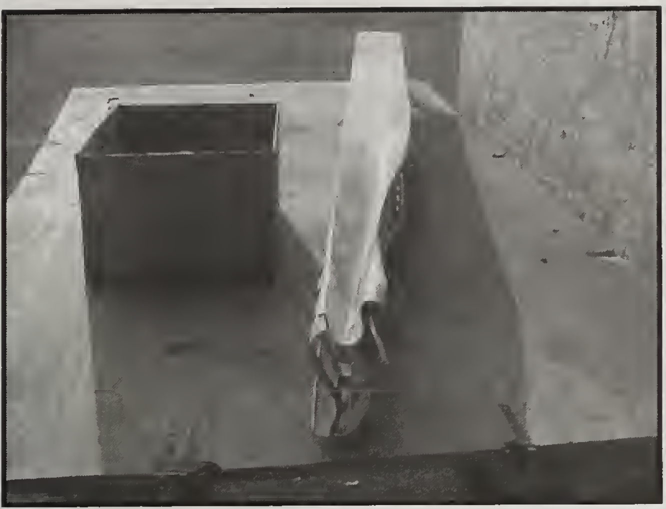
$$\Delta_{inches} = (((T_{Farenheit} - 41)/27) (L_{feet}/40) (.48))$$

If you are faced with an existing slab that was not poured with this expansion in mind, there are two adaptations that can help minimize form expansion and fit the walls to the slab. If the projected wall overhang is large, examine the plans to see if there are any RBS panels you can remove from the form structure to meet the slab size. If the projected overhang is small, tap the panels tightly together with rubber mallets during assembly. RBS staff engineers have stated that the form expansion is otherwise irreversible, so if the modifications above are not enough, you may need to accept and manage wall overhang on the slab.

Form expansion is not the only challenge heat brings to RBS construction. In temperatures higher than 30°C or 87°F, RBS panels begin to soften. Softened form walls become more susceptible to hydraulic pressure from fluid concrete and tend to bow outward when filled. In El Salvador, the high heat and fluid concrete combined to create schoolhouse walls with noticeable inward and outward bends and even form blowouts.

To minimize the distortion and control possible blowouts, first cool the forms with a light spray of water. Not only will this stiffen the forms slightly by cooling them, but it will also help the concrete fill the forms completely and minimize air pockets. After spraying, fill the forms in thinner lifts, using five or six lifts instead of the typical three. This reduces the amount of fluid concrete in the forms at any one time and thus the hydraulic pressure exerted on the softened forms. Third, combine these thinner lifts with increased wall bracing. In the heat of El Salvador, however, the bracing had to be tripled and augmented by additional braces within the structure to produce smooth, straight walls with a pleasing appearance.

Soldiers work on the school at Zamoran.



A heat-damaged RBS panel

Storage

During shipment and storage, strict handling requirements must be followed to prevent damage to RBS panels. Panels that are at the bottom of large stacks, or have additional equipment piled on top of them, become irreversibly warped, particularly in the heat. In most cases in El Salvador, engineers could still fit warped components into the formwork once pieces had softened in the sun, but these pieces cost a good deal of labor time and effort to force into place. In the worst cases, however, some panels were completely unusable.

When temperatures regularly exceed 30°C (87°F), the following steps are recommended to protect RBS components:

- Store vinyl components in the shade or cover with loose tarps that provide shade but still permit airflow.
- Do not store vinyl components in unvented containers, as these can become hot enough to melt RBS parts.
- Store all components in flat, straight piles with continuous support underneath. If components are stored without even and flat support, they will become permanently warped.
- Do not store other equipment on top of RBS panels. In temperatures over 30°C (87°F), do not stack RBS panels more than 1 meter (40 inches) high.

Quality Control

With CMU construction, progress on the walls is gradual, and leaders have time to identify problems and correct them as they occur. Individual blocks that are out of line are easily identified and can be adjusted, or even knocked out and replaced. With the RBS, once the concrete is poured into the forms and sets, nearly all the previous steps of construction become irreversible. Consequently, quality control of every detail before filling the walls with concrete is necessary. A full workday dedicated to quality control—including rechecking the formwork level and plumb, bracing tightness, and rebar connections—produces the best results.

BOM Management

With CMU construction, if blocks are lost or broken in storage, one simply obtains more blocks, since CMU blocks are virtually identical from block to block, vendor to vendor, and even country to country. But with the RBS, if you break or lose a component you're stuck, since the nearest replacements may be in storehouses in Ontario. In the worst cases, components may have been custom-made for your project and may need to be remanufactured.

Even if all the RBS parts are intact, it is easy to misuse them. Most parts can be connected easily to other parts, and many look very similar to each other. Without supervision, engineers may use wall sections without conduit where plans call for conduit, or even insert sections with very slightly different widths in the wrong locations in the walls, creating opposite walls of unequal lengths.

In operational terms, what this means is that RBS components must be carefully inventoried, stored, and accounted for throughout construction. Outside of North America, loss, destruction, or accidental misuse of components is irreversible in a practical time frame. Rather than being an "extra duty" assigned to an unlucky junior NCO you don't trust to swing a hammer, managing RBS components is a valuable mission that is best performed by an experienced BOM manager.

Concrete Pumping System

RBS construction depends on crews being able to fill the form from above with concrete. In North America, this is usually done with a well-regulated concrete pump operated by crews on scaffolding. If all else fails,

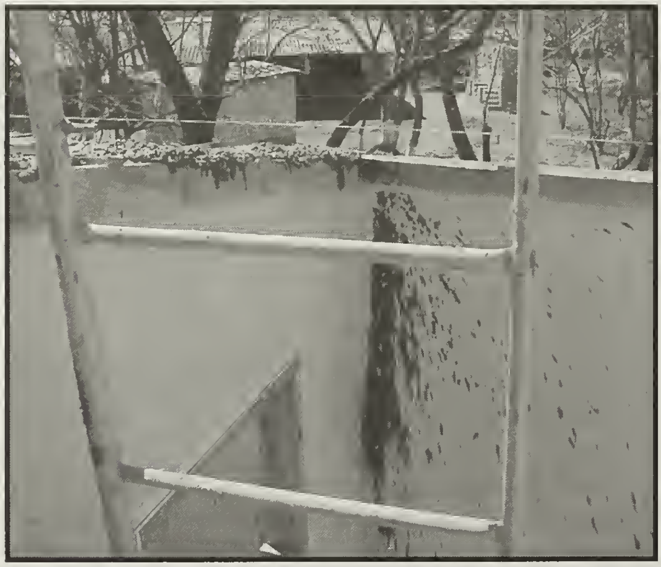
Using a concrete bucket to fill the panels

The pump detail uses the large-volume hose to fill the panels.

engineers with ladders and pails of concrete could fill the forms, but this would take a very long time. For efficiency's sake, every effort should be made to find a concrete pump, either to deploy with your unit or to be on hand at your destination.

In general, lower-volume pumps are preferable to higher-volume pumps when filling RBS forms. Higher-volume pumps tend to create thick lifts, which create more hydraulic pressure and distort the forms under hot operating conditions. Higher-volume pumps also have larger-diameter hoses that become extremely heavy when filled with concrete. In North America, with a well-regulated pump, contractors generally start and finish a pour with one crew.

In El Salvador, the only available concrete pump in the region was a large-volume pump used for quickly pouring industrial slabs. The "pouring crew" was a grueling six-man detail that had to be rotated every 20 minutes as soldiers grew tired from steering the heavy, bucking concrete hose into the narrow RBS wall panels. This large-volume hose had a wider diameter than the RBS panels, which allowed concrete to spray over the surfaces of outer walls, requiring additional cleanup before the concrete hardened.



Spillage resulting from using an oversize pump

An alternative to a missing or an inappropriate concrete pump was used in Nicaragua. Here, a basin of concrete was suspended with a crane over an RBS wall. By managing a chute from this basin, engineers could gravity-feed concrete into the forms. This was much less work for the engineers and used labor and concrete more efficiently. However, it required lowering and refilling the basin often and was somewhat slower.

Maximum filling efficiency with the RBS can only be obtained with a concrete pump having a hose or nozzle diameter smaller than the width of the RBS panel you are using. Other options are available, but these will absorb more manpower, equipment, and time.

Summary

The RBS is simple to use and creates concrete or reinforced-concrete walls superior to CMU walls. RBS construction has the potential to be dramatically faster than standard CMU construction. But to attain this speed, task forces need to be familiar with the RBS, be trained in their other construction tasks, manage RBS BOM carefully, adapt construction techniques to hot weather, and ensure that suitable concrete-delivery systems are available. Otherwise, the RBS will create sturdier buildings than with CMU construction, but it will not necessarily do so faster or more efficiently.

Captain Pickands, who is now attending the Engineer Captain's Career Course at Fort Leonard Wood, Missouri, was chief of projects at Joint Task Force–Bravo, Soto Cano Air Base, Honduras, when this article was written. Previously, he was the deputy secretary of the general staff and deputy division G5, 1st Infantry Division, and engineer operations officer for Joint Task Force–Kelly. CPT Pickands holds a bachelor's in political science from Cornell University and a master's in international training and education methods from American University.

For more information concerning New Horizons projects and planning, contact the USARSO DCSEN engineer planner, presently Major Humberto Ramirez (ramirezh@usarso.army.mil).

For more information on the Royal Building System and its applications, visit the company's Web site at www.rbsdirect.com.

Engineer Safety

Hazards of the M9 Armored Combat Earthmover (ACE)

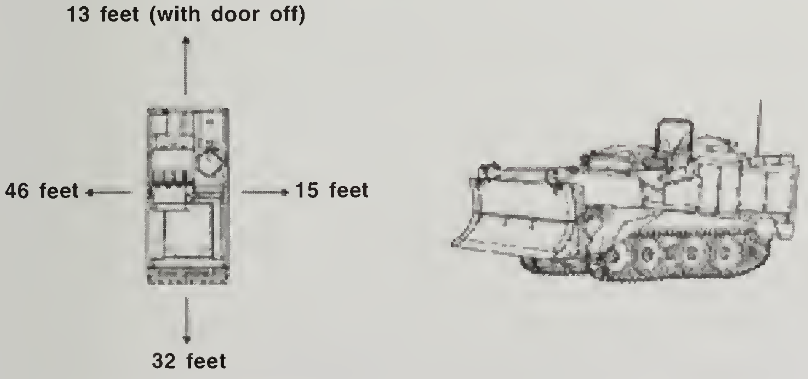
By Ms. Vicki Hall

Combat engineers are accustomed to finding themselves in precarious positions. However, many do not know that operating the ACE might be one of those instances. From the beginning of their training, operators are cautioned about the unique characteristics that make the ACE difficult to maneuver on most terrain and roadways. Additionally, recent cutbacks in equipment or personnel have decreased the amount of "throttle time." Even students who are selected to attend advanced individual training on the ACE only receive a limited amount of behind-the-wheel experience.

When soldiers receive their first permanent duty assignment, the gaining commanders sometimes make the assumption that the soldiers know how to drive the ACE because they recently completed their formal school training. Nothing could be further from the truth. Soldiers are familiar with the vehicle's inner workings, how to properly perform preventive maintenance checks and services, how to spot a defective track, and how to troubleshoot some of the systems. However, training must continue at the first duty station and throughout the soldiers' tenure with their unit. Ongoing proficiency training and testing must also be a part of the soldiers' everyday routine.

A key element in training is ensuring that visibility or the lack thereof is explained to the new operators. When properly seated, they are at a disadvantage—they cannot clearly see obstacles directly adjacent to the vehicle. On level ground, with the operators seated, the "blind" spots range from 13 feet to the rear to 46 feet to the right (see figure). If the vehicle is on an incline, the distances of blind spots change dramatically. This factor is often not stressed during prebriefings, risk assessments, and after-action briefings. Soldiers must remain aware of their position in relation to everyone and everything else in the area in which the vehicle is operated.

M9 ACE Operator Visibility Chart



All distances shown are on level ground. Drivers cannot see objects or hazards within these distances.

Measurements are not to scale.

Operators must be thoroughly familiar with the capabilities of the vehicle. They must know, instinctively, where the vehicle is located in relation to the surroundings. This cannot be taught in school; it comes from hands-on experience. Commanders at all levels must ensure that operators are given ample opportunity to train before being placed in a dangerous situation with an unfamiliar vehicle. A dangerous situation can be nothing more than a roadway with a drop-off. For example, some drivers have driven the ACE off the road surface and down an incline because they could not see the edge of the roadway.

The ACE is designed to function as a bulldozer in combat conditions. However, the majority of the accidents have involved the vehicle being operated in either training or convoy scenarios. Engineer branch accident experience began in 1990 when two Army reservists (both E7s) were killed while riding on the outside of the operator's compartment. The driver lost control while driving at an excessive speed for the conditions, causing the vehicle to overturn, killing both persons outside the protection of the cab.

From this dramatic beginning, causes of accidents have stabilized and now range from operator error to track failure, which causes the vehicle to overturn. If operators are properly secured in the cab—properly seated and restrained with belts—they can survive a rollover. Rollover drills are a vital part of the training process and must be diligently conducted. The senior person on the vehicle is responsible for ensuring that all safety measures are enforced.

More complex missions and austere resources have become a way of life in the military. Loss prevention for both equipment and personnel is paramount to an effective fighting force. This means that accident prevention is everyone's business. We must all keep a watchful eye on daily routines, identifying potential problem areas before they become problems, and changing the way we do business. The blind spots on the ACE are just one example of hazards that are present. If you, as an operator or leader, make sure your soldiers know of this hazard and teach them how to operate within its contraints, you can prevent future accidents.

For additional information on this or any other safety subject, refer to the MANSCEN Safety Web site at *http://www.wood.army.mil/safety/*.

Ms. Hall is a safety specialist for the Engineer Branch, U.S. Army Maneuver Support Center Safety Office, Fort Leonard Wood, Missouri.

The French Engineer School and U.S. Army Engineer Training Opportunities in France

By Major Andamo E. Ford

The *École Supérieure et d'Application du Génie*, or French Engineer School, located in Angers, France, is the home of the French Engineer Corps and the training center for engineers in combat and technical skills. The school has two missions:

- Train future army officers and noncommissioned officers (NCOs) in the craft and culture of engineers, in three branches of the Engineer Corps: combat engineering, infrastructure, and civil defense. The school provides specialized training in civil defense on the techniques of lifesaving and clearing debris for missions during natural disasters.
- Perform doctrinal studies in the future employment of engineers and engineer equipment for operations worldwide.

To optimize personnel and equipment resources, the various engineer training establishments (equipment operators, electricians, mechanics, etc.) were consolidated in Angers. This reorganization was completed in 1995 with the fusion of the Technical Engineer School from Versailles and the Combat Engineer School in Angers.

The school trains about 3,000 students per year, with training covering more than 60 different courses. Students may attend courses ranging from a few days to two years for technical degree programs. A major characteristic of the school is its student diversity. Representing 25 different countries, students are officers; NCOs; soldiers; Ministry of Defense civil servants; and personnel from other branches, services, and government departments. The school is also responsible for intensive mine awareness training for more than 5,000 military and civilian personnel per year.

Organization

The school is organized into four levels:

Command Group. Consists of the general, the commanding officer, and the headquarters staff.

Administration and Resources Section. Covers all the functions required for operating the school.

Training Directorate. Including both the student courses and the facilities needed to train them, the directorate is divided into two areas:

- **Student Management Division**
  - √ *Division d'Application* (officer basic course)
  - √ *Division Sous Officiers* (NCO courses)
  - √ *Cours de Futurs Commandants d'Unite* (captain's career course)
  - √ *Diplôme Technique* (technical courses)
- **Training Departments**
  - √ *Departement Formation Operationelle* (tactics)
  - √ *Departement Formation Technique d'Arme* (engineer skills)
  - √ *Departement Enseignement Scientifique et Technique* (technical courses)

- √ *Departement d'Enseignement Physique et Sportif* (sports and fitness training)
- √ *Departement Formation de l'Exercice de l'Autorité* (leadership)

Support Group. Furnishes the troops needed to support practical training of students.

To carry out the missions, the school has several specialized installations, which include local training areas and camps, bridging schools on the Maine and Loire Rivers, diver training facilities, and other specialized facilities. The school also has ties to the civilian academic world, including universities and training institutions, which play an increasingly important role in technical training. About 40 civilian professors and instructors teach courses at the French Engineer School every year. This demonstrates a recognition of the quality of instruction.

Restructuring the French Army

The French Army has undergone profound changes, and as a result, there was a significant reduction in manpower. There are now just 85 total regiments, 11 of which are engineer. Eight engineer regiments are assigned and support each armored, infantry, and mechanized brigade. The other three are assigned to the French Engineer Brigade, located in Strasbourg along with a nuclear, biological, and chemical (NBC) group and a topographic group (not shown in the chart on page 30).

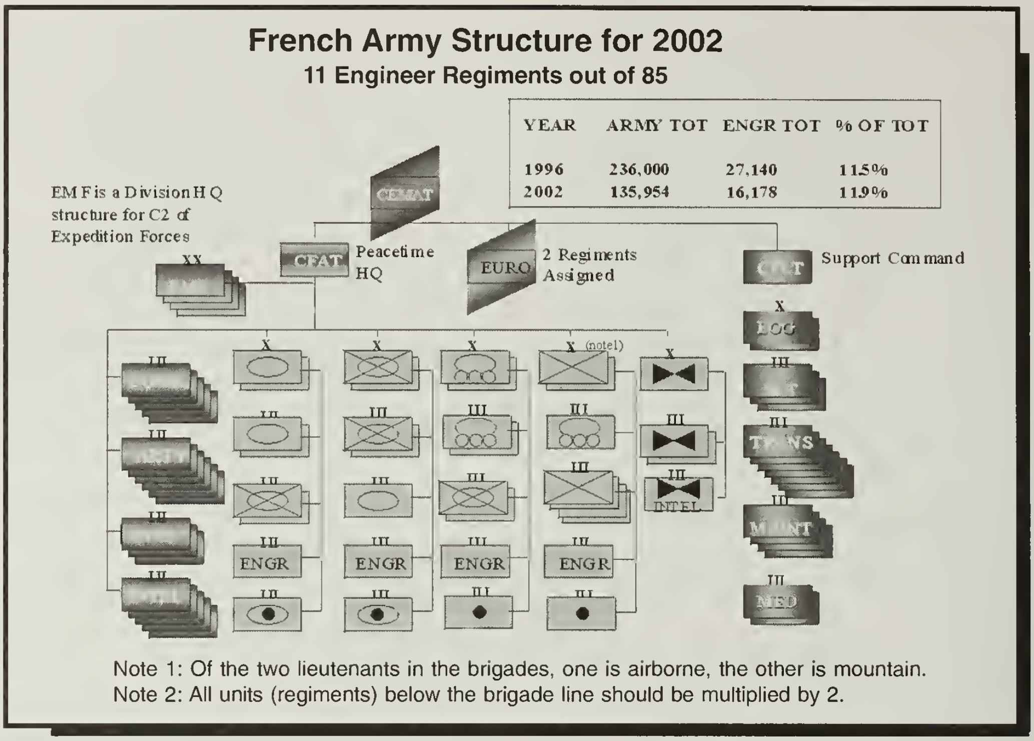
Over the period of army restructuring, the military manpower at the French Engineer School has diminished by 60 percent—from 1,500 to 630, which has impacted the support group—although there has been an increase in civilian personnel in administrative functions. The challenge is to train the same number of students, while maintaining the quality of instruction with less than half the original manpower.

Partnerships and contracting out are possible solutions to the manpower problem. To provide the practical training support, despite the disappearance of most of the support group, an arrangement has been established with the field army in which it provides the troops and equipment necessary to carry out field exercises. Contracting out allows some support and administrative functions to be provided by civilian companies, thereby saving military manpower. These contracts are expensive and cannot be expanded. Contracting out some of the training to civilian organizations or calling on external instructors, although they are already in place for technical training, is more difficult for specific military-type training.

Liaison Officer Program

The Liaison Officer Program is supported by selected elements of allied defense establishments for the mutual exchange of information on combat development, doctrine, training, and educational information with appropriate personnel. Liaison officers act as TRADOC emissaries to facilitate the exchange of information and fulfill the host activity's requirements for information. Liaison officers represent the commandant of the U.S. Army Engineer School in France and effect and enhance coordination between the two countries on matters relating to doctrine, training, force structure, and equipment. They initiate, organize, and participate in joint studies, visits, and training activities designed to extend interoperability and improve understanding between the two armies. Liaison officers coordinate with the French research, development, and acquisition community. They operate independently under broad guidance from the

Students at the French Engineer School



French Army Structure for 2002

11 Engineer Regiments out of 85

YEAR	ARMY TOT	ENGR TOT	% OF TOT
1996	236,000	27,140	11.5%
2002	135,954	16,178	11.9%

Note 1: Of the two lieutenants in the brigades, one is airborne, the other is mountain.
Note 2: All units (regiments) below the brigade line should be multiplied by 2.

commandant of the U.S. Army Engineer School in the following areas:

Unit Visits. Work with the French army, the French Engineer School in particular, and engineer regiments around the country. Throughout the year, they visit engineer regiments to receive their latest mission/capabilities briefs.

Exchanges. Schedule various exchanges and training opportunities for U. S. Army Engineer and explosive ordnance disposal (EOD) units and individual soldiers either at the French Engineer School or with French engineer units.

Briefings and Presentations. Brief and teach classes in either English or French on the U.S. Army and engineers to the French equivalent of the Engineer Captain's Career Course (ECCC) and additional officer and NCO basic and technical-level courses.

Training and Testing. Help the U.S. Army Command and General Staff College liaison officer to the French army conduct English language testing of French captains. The intent is to test staff officers' proficiency in the use of U.S. operational terminology (operational English).

English language testing is an integral part of the training that French captains receive at their staff course, which all French officers must attend. The six-month course, which is equivalent to a combination of the ECCC and Combined Arms and Services Staff School (CAS3), consists of about 200 officers. U.S. and British officers conduct English language testing throughout the year. However, American English is critical to the success of a French officer's career, which means that the staff course has increased the involvement of Americans in all aspects of the course curriculum. Liaison officers also participate in training exercises throughout the year. They act as a higher-level commander, adjacent unit commander, or liaison officer receiving tactical operations order briefings.

Training Opportunities in France

U.S. Army engineers receive invaluable training from the French engineers each year. Recently, a U.S. Army engineer captain attended the CFCU, the French Engineer School's equivalent to the ECCC, and 16 officers and NCOs attended a one-week course conducted specifically for U.S. Army officers and NCOs that focused on demining operations in the Balkans. The French Engineer School continues to develop and train in the most up-to-date demining techniques in the world. It continues to emphasize the role of demining awareness and planning to all of their junior leaders. The school has the requirement for mine awareness training for the entire French army. The emphasis on demining training to junior officers and NCOs is typical of the importance placed in all branch schools as French army and engineer units are present on various operations worldwide.

These training opportunities are conducted through the International Military Training Office, 7th Army Training Command, Germany. Contact Mr. Art Brown at (011) 49-96-41-83-8449/8450 or e-mail *browna@hq.7atc.army.mil.*

Captain's Career Course

The 11-week CFCU is designed to prepare a captain for company command. The course flows in a progressive, mission-oriented manner. Blocks of instruction are not organized by subject area—such as construction, demining, or leadership—but by mission (for example, employing a unit in a peacekeeping operation). Subject areas are taught throughout the course as they apply to the mission type. The course is divided into two blocks:

Block I. The captain prepares the unit for employment.

- Exercise command. Includes communications/leadership/ command, training/ educating, and security.
- Know the environment. Includes the battlefield, enemy, other branches and their relationship to engineers, and engineer branch (missions, structures, principles, etc.).
- Optimize resources. Includes giving orders; organizing, conducting, and inspecting training; and managing personnel and materiel.
- Prepare unit for operations. Includes mobilization and deployment, planning (the military decision-making process), and force protection/NBC operations.

Block II. The captain employs his unit in an operational mission.

- Support combat operations.
- Support peace operations.
- Support civil authorities (disaster relief, civil defense, etc.).

The majority of instruction is devoted to tactical or combat engineering training. Sustainment engineering training is limited to deployment support missions such as base camp construction and route maintenance. The course consists of two sessions per year with about 30 captains per course. The average age of the French officers in CFCU is 30. About 70 percent have a college degree and an average of six to seven years experience in units, although some have as little as three years experience. The course is open to many foreign army officers.

Engineers who are interested in attending the French CFCU should meet the requirements below. Attendance at this course is in conjunction with a permanent change of station (PCS) to Europe.

- Be a first lieutenant (promotable) or a captain.
- Speak and comprehend French. (The course is taught entirely in French).
- Have completed the U.S. Army ECCC and CAS3—or be scheduled to attend these courses—and be eligible for a PCS move.
- Have not participated in the University of Missouri-Rolla master's program.
- Attend French engineer officer's advanced course (unaccompanied) TDY in conjunction with a PCS to Europe.
- Volunteer for the course.

Officers interested in attending the French CFCU should first contact their assignments branch manager at PERSCOM. Other important contacts include Ms. Victoria Anthony at the Engineer Personnel Proponency Office, U.S. Army Engineer School, (573) 563-6137, DSN 676-6137, e-mail *anthonyv @wood.army.mil*, or Major Andamo E. Ford, U.S. Army Engineer Liaison Officer (France), (011) 33-24-12-48-279, e-mail at *TRADOC.FR.ENLO@Wanadoo.fr* for additional information.

Demining/Mine Exercise (MINEX) Course

At least twice a year, the French Engineer School schedules a course for U.S. Army engineers and EOD units that is designed as a "train-the-trainer" course for leaders (NCOs and officers). Subjects covered during the course include—

- Learning about the French EOD branch.
- Demining according to international standards.
- Identifying and treating antipersonnel mines in the Balkans and Afghanistan.
- Identifying and treating antitank mines in the Balkans and Afghanistan.
- Demining in the Balkans and Afghanistan.
- Organizing and conducting a mine clearance worksite (classroom instruction).
- Identifying and treating rockets and missiles in the Balkans and Afghanistan.
- Identifying and treating grenades in the Balkans and Afghanistan.
- Identifying and treating booby traps in the Balkans and Afghanistan.
- Identifying and treating antipersonnel and antitank mines in a field environment.
- Using demining tools.
- Organizing and conducting a mine clearance worksite (in a field environment).
- Monitoring demining operations.
- Becoming familiar with the mine situation in Bosnia, Kosovo, and Afghanistan.

Transportation, lodging, and course fees are at no cost to the unit. Funding is handled by 7th Army Training Command, Germany. The point of contact is Mr. Art Brown, (011) 49-96-41-83-8449/8450, e-mail *browna@hq.7atc.army.mil*, or Major Andamo E. Ford, U.S. Army Engineer Liaison Officer (France), (011) 33-24-12-48-279, or e-mail *TRADOC.FR.ENLO @Wanadoo.fr* for additional information.

Major Ford has been a U.S. Army engineer liaison officer to France since June 2000. Previous assignments include commander, HSC, 84th Engineer Battalion (Combat) (Heavy), Schofield Barracks, Hawaii; battalion maintenance officer, 84th Engineer Battalion (Combat) (Heavy); and tactical support team commander and operations officer, D Company, 96th Civil Affairs Battalion (Airborne), Fort Bragg, North Carolina.

CTC Notes

National Training Center

Opposing Force's (OPFOR's) MTK-2

By Captain Thomas F. Nelson and Sergeant First Class Gary A. Smith

As the National Training Center (NTC) continues to implement the contemporary operational environment, the OPFOR will adjust its equipment inventory to better match threat capabilities. The MTK-2, the latest addition to the engineer inventory, provides the OPFOR with an explosive reduction capability that greatly enhances its flexibility across the battlespace. Though there are several sources that differ in their descriptions of the MTK-2, the NTC based its system on TRADOC's worldwide equipment guide and implemented an addition to NTC's rules of engagement (ROE).

MTK-2 in operation

Capabilities

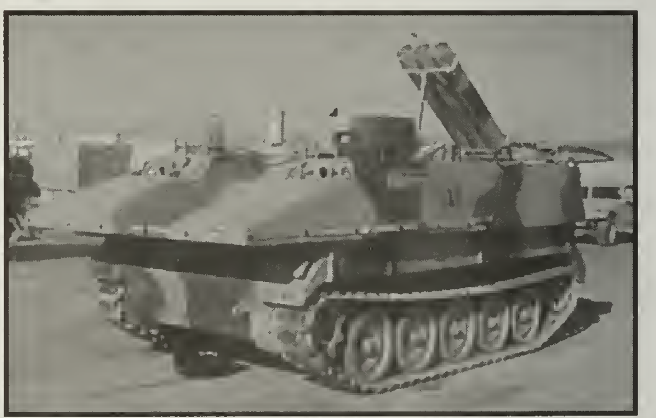
Based on the 2S1 self-propelled howitzer chassis, the MTK-2 has a turret-like superstructure that contains three UR-77 rockets on launch ramps. The range of the rockets is about 200 to 400 meters. Each rocket is connected via a towing line to 170 meters of mine clearance hose that is stowed folded in the uncovered base of the turret on the vehicle roof. The hose, with pressure fuses, is command-detonated to clear a path up 140 meters long and 6 meters wide through minefields. The MTK-2 is capable of operating in a nuclear, biological, and chemical environment and has good cross-country capability.

Characteristics

The visual modification (VISMOD) of the MTK-2 is built up on an M113 chassis and includes the launching tubes and Smokey Sam rail. The organic OPFOR engineers, the 58th Engineer Company, configured three MTK-2 VISMODs. The MTK-2 will fight as a component of the movement support detachment for offensive missions. It will use the Multiple Integrated Laser-Engagement System (MILES) II.

NTC MTK-2 ROE

The MTK-2 is a similar vehicle to the U.S. Army armored vehicle-launched mine-clearing line charge (MICLIC) (AVLM); therefore, the OPFOR will simulate reduction with the MTK-2 using the same procedures as for the AVLM.



MTK-2 VISMOD (with launch tubes raised)

For each charge, 100 x 7 meters are allowed. The tank commander (or third crew member) will dismount from the vehicle and walk the vehicle through the minefield. An observer/controller will remove mines as the tank commander encounters them (only the mines directly in front of the vehicle to create a 7- by 100-meter lane).

The OPFOR will not transport an engineer squad in the MTK-2 VISMOD during offensive operations, nor will the vehicle be used in conjunction with the obstacle detachment.

The points of contact (POCs) for OPFOR engineer issues are CPT Tom Nelson (Red Devil 6), e-mail *NelsonTF @irwin.army.mil* and SFC Gary Smith (SW09), DSN 380-5151 or e-mail *Sidewinder09@irwin.army.mil.*

Leader's Training Program (LTP)

By Major Michael W. Rose and Captain Thomas B. Hairgrove, Jr.

The NTC offers a six-day LTP about 120 days before a scheduled rotation. Though the Wrangler Team is responsible for the brigade LTP, the Sidewinders provide additional resources to enhance the LTP experience.

LTP Attendees and Tools

To get the most from the LTP, the Sidewinders recommend that the following engineer battalion personnel attend:

- Battalion commander
- Battalion executive officer (XO)
- S3
- S2
- Assistant brigade engineer
- Assistant S3 (planner or battle captain)
- S1 or S4
- Company commanders
- Company XOs
- Specialty leaders (light engineer platoon, combat support equipment, explosive ordnance detachment)

The following tools are recommended:

- NTC maps
- Modified combined obstacle overlay of NTC
- Pluggers
- Laptop computers
- Printer
- Tactical standard operating procedure (SOP)
- Binoculars
- Digital camera
- TerraBase w/ MrSids Imagery
- NTC ROE
- Field Manuals 101-5, *Staff Organization and Operations*; 101-5-1, *Operational Terms and Graphics*; 3-90.3, *The Mounted Brigade Combat Team*; 5-71-3, *Brigade Engineer Combat Operations (Armored)*; 5-71-2, *Armored Task-Force Engineer Combat Operations*; 20-32, *Mine/ Countermine Operations*; 90-7, *Combined Arms Obstacle Integration*; and 3-34.2, *Combined Arms Breaching Operations*.

Planners 101

The Sidewinder team conducts two classes during an LTP that are designed to enhance the performance of the engineer battalion planners. Both battalion and company-level planners benefit from the session. The first class is *NTC Terrain Analysis*; it focuses on how to provide the "so what" of terrain to the commander. The second class, *Engineer Planning at the Basic Combat Training and Task Force Level*, provides a planner's overview and tactics, techniques, and procedures (TTP) for planning in a time-constrained environment.

Brigade Combat Team Classes

The following classes are also available, by request, for either the engineer battalion and/or the brigade LTP participants: *Combined Arms Breaching Operations* and *Combined Arms Obstacle Integration.* Since trends at the NTC indicate that these two subjects pose significant challenges to brigade combat teams, we recommend that units work through their brigades to schedule these classes.

The POCs for the LTP are MAJ Michael Rose (SW03), e-mail *Sidewinder03@irwin.army.mil,* and CPT Tom Hairgrove (SW03B), DSN 380-5151, or e-mail *Sidewinder03B @irwin.army.mil.*

Reception, Staging, Onward Movement, and Integration (RSOI) MICLIC Range

By Captain James R. Koeppen and Major Michael W. Rose

To improve the battlefield performance of combat engineers, in particular MICLIC employment, the 52d Infantry Division now mandates in-theater training on the MICLIC by RSOI 4. Historically, units that have fired live rockets and high-explosive line charges during RSOI have maintained better MICLIC launcher operational-readiness rates and have had fewer misfires during the live-fire portions of their rotations. The Sidewinder team recognizes the tremendous potential this additional training offers and will ensure that every effort is made to include this event in each rotation.

Initial coordination for the RSOI MICLIC Range should occur during the LTP. During the LTP, the Sidewinder Team will provide the unit with a compact disk (CD) containing the MICLIC Range SOP that has a general overview of the event, rotational unit responsibilities, range layout with surface danger zones, sample memorandums required by Fort Irwin Range Control, Fort Irwin POCs, and a sample battalion operations order (OPORD). A MICLIC CD is also available from the Sidewinder team and includes TTP, photos, and other information to prepare units in their train up.

A MICLIC detonation

The following are keys to successful execution of the RSOI MICLIC range:

- This is a battalion effort; a single company cannot plan and resource this training.
- Issue a battalion OPORD for this training before deployment.
- Get the range officer in charge and range safety officer to range control on RSOI 1 or during the LTP.
- Coordinate with the Sidewinder team for MICLIC inspections on RSOI 2 or 3.
- Check your blasting machines with voltmeter (M34–220 volts, CD450-4J–220 volts, and a fresh 9-volt battery).
- Draw ammo no later than 1600 RSOI 3 and coordinate with the Sidewinder team to conduct joint inspection of ammo on RSOI 3.
- Plan to begin range operations no later than 0700 on RSOI 4; this will get you off the range by 1200.
- An M985 heavy expanded, mobility tactical truck (HEMTT) is required (M977 series does not have lift capacity for MICLIC tubs).

The POCs for the RSOI MICLIC range are MAJ Michael Rose (SW03), e-mail *Sidewinder03@irwin.army.mil* and CPT Jim Koeppen (SW11), DSN 380-7055, or e-mail *Sidewinder11 @irwin.army.mil.*

AIRBORNE

Joint Readiness Training Center

Troop-Leading Procedures (TLPs) for Task Force Engineers

By Captain Mark C. Quander

A trend that has become prevalent at the Joint Readiness Training Center (JRTC) among rotational engineer units is the lack of thorough TLPs. This has resulted in vague tasks and purposes for squad leaders and poor allocation of troops to engineer tasks. While most people understand the definition of TLPs and their functions, rarely are TLPs ever executed. Engineers have a method of linking the military decision-making process (MDMP) and TLPs through the engineer estimate (see Figure 1). Some of the critical issues observed at the JRTC follow.

Issuing Warning Orders (WARNORDs)

While missions are received and WARNORDs issued, it is common that the WARNORDs are incomplete. Key items missing from them include a clearly stated mission, specified subunit tasks with a purpose, critical precombat checks (PCCs) and precombat inspections (PCIs), and a tentative time schedule. Tentative plans are normally inadequate since proper mission analysis—which includes the engineer battlefield assessment (EBA), specified tasks, implied tasks, and facts and assumptions—are not delineated and known. Platoon- and squad-level operations orders (OPORDs) are normally only very detailed WARNORDs and lack the coordinating instructions necessary for integral and synchronized combined-arms fight. Doctrinally, leaders should issue three WARNORDs; at a minimum, they should address the—

- Higher headquarters restated mission (WARNORD #1).
- Terrain analysis and associated products (WARNORD #2).
- Engineer enemy composition, disposition, and strength (WARNORD #2).
- OPORD location and time (WARNORD #2).
- Updated timeline (WARNORD #2).

Relationship Between the Military Decision-Making Process, the Engineer Estimate, and Troop-Leading Procedures

Military Decision-Making Process	Engineer Estimate	Troop-Leading Procedures
Receive the mission	**Receive the mission** - Issue the WARNORD to subunits	**Receive the mission**
Develop facts and assumptions	**Conduct IPB/EBA** - Enemy engineer capability - Friendly engineer capability - Impact of terrain and weather	**Issue a WARNORD** - State the mission - Specify essential tasks to subunits, critical PCCs - Issue timeline
Analyze the mission	**Analyze the engineer mission** - Specified tasks - Implied tasks - Constraints - Limitations	**Make a tentative plan** - Backward plan action from the objective(s) - Assign mission to subunits - 1/3 - 2/3 time management rule - Subunits conduct PCCs
Issue the commander's guidance	**Develop the SOEO** - Resource the essential tasks with generic units and specific classes of supply	**Initiate necessary movement**
Develop courses of action (COAs)	**War-game and refine the engineer plan** - Focus on key events in the operation - Backward plan from the objective(s) - Identify shortfalls in resources - Identify benefits and risk for each course of action (COA)	**Conduct reconnaissance** - Leader reconnaissance of critical objective areas - Subunits conducting individual and squad rehearsals
Analyze COAs	**Recommend a COA**	**Complete the plan** - Modify the tentative plan based on results of recon
Decide on a COA and issue orders	**Finalize the engineer plan and issue orders**	**Issue the operations order** - Key leaders attend - Brief on terrain model or sketch - Graphics and execution matrix to squad level **Inspect, supervise, and rehearse** - Leaders conduct PCIs - Rehearsals at squad, platoon, and combined-arms levels

Figure 1

- Subunit instructions (WARNORD #2).
- Types of rehearsals and locations (WARNORD #3).

Developing the Scheme of Engineer Operations (SOEO)

Another prevalent trend is the lack of information in the SOEO paragraph, which is directly linked to platoon leaders failing to issue a task and purpose to subordinate units. Task force engineers conduct limited EBAs that do not fully support the task force's mission analysis. These deficiencies in the initial planning phases lead to an inability to better impact and multiply the mobility/survivability effects of the task force maneuver plan. A clearly stated task and purpose with complementing SOEOs is generally absent from orders.

Task force engineers can help overcome this problem by conducting a thorough EBA and then, with the commander's guidance, fully participating in the COA development of properly allocating troops to engineer tasks. During the construct of the EBA, they should, in concert with the battalion S2, conduct an intelligence preparation of the battlefield (IPB). It is then that they will develop the enemy engineer situational template, continually updating the information. Some call this reverse Battlefield Operating Systems (BOSs). You identify to the battle staff what you think the enemy engineers will do, given resources and available time. At the conclusion of the mission analysis, the task force engineer should be able to clearly articulate the enemy engineer capabilities, friendly engineer capabilities, and the effects that terrain and weather will have on the operation to both friendly and enemy forces

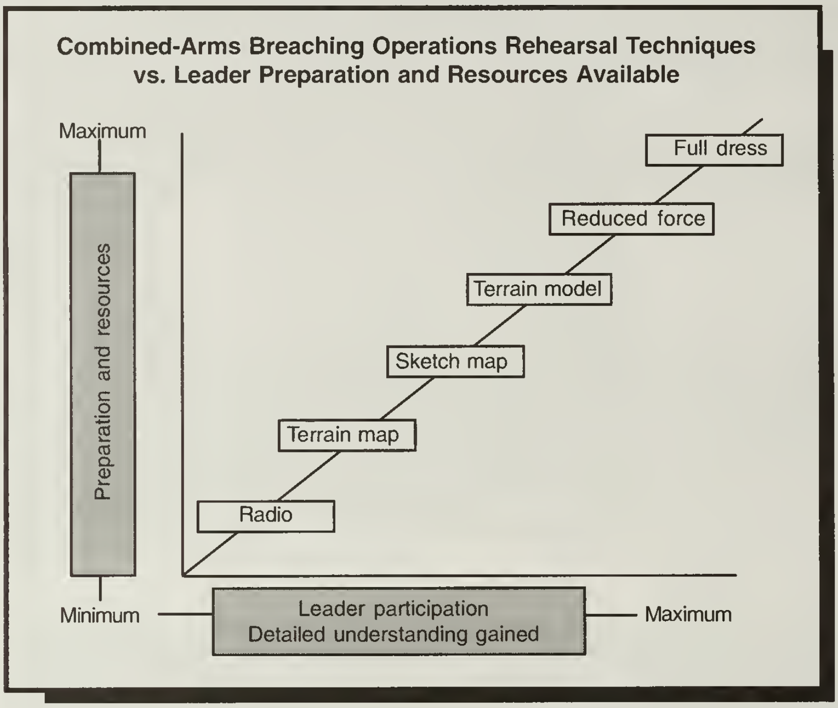

Combined-Arms Breaching Operations Rehearsal Techniques vs. Leader Preparation and Resources Available
Maximum
Preparation and resources
Minimum
Full dress
Reduced force
Terrain model
Sketch map
Terrain map
Radio
Leader participation
Detailed understanding gained
Maximum

Figure 2

and whom it favors. Friendly engineer capabilities should not just focus on what assets are available. They should also focus on what the engineers can do with those assets down to how many breaches they can conduct or how much minefield frontage they can emplace with time and resources available. Task force engineers should also look at the other BOSs and see how they can assist the engineer effort in shaping the battlefield for task force commanders.

Once the task force engineers have completed a detailed EBA and understand the commander's guidance, they can begin identifying the task and purpose of engineer subunits. They will have proper troops for engineer tasks and can communicate this to the squad leaders or other engineer units in a second WARNORD and eventually the SOEO.

Rehearsing

Platoons conduct very few rehearsals, and those that are conducted focus only on the basic engineer missions. Full-force combined-arms rehearsals are generally absent. The engineer-only rehearsals are mainly conducted as "talk-throughs" and never address an uncooperative enemy or a contingency plan. During the issuance of the WARNORD, or at least the OPORD, the task force engineers/platoon leaders should specify what actions to cover during the rehearsal and the type of rehearsal to conduct.

Task force engineers also fail to identify critical engineer tasks that serve as their "actions on the objective"; therefore, they do not make those tasks the priority for rehearsals. They should give specific guidance for what to rehearse during the MDMP to the platoon sergeant so he can prepare the platoon as planning continues. The platoon sergeant must fully understand what type of rehearsals the platoon leader wants to conduct (confirmation brief, back brief, combined-arms rehearsal, support rehearsal, battle drill) and the various techniques so time is not wasted (see Figure 2). Failing to conduct rehearsals to standard also prevents a unit from identifying shortcomings in the plan.

The lack of combined-arms rehearsals degrades the platoon's effectiveness in areas such as communication from squad to platoon, understanding individual responsibilities for the mission, and actions on contact. Platoon leaders must vehemently insist on combined-arms rehearsals, conduct detailed engineer-specific rehearsals, and apply analysis to decide the appropriate rehearsal type and technique. There are various tools and techniques for combined-arms rehearsals in FM 3-34.2, *Combined-Arms Breaching Operations*. The more detailed the rehearsal, the greater understanding the soldiers will gain.

Summary

Task force engineers must learn to balance task force engineer duties and responsibilities as well as those of platoon leaders. The task force engineer will fail to accomplish the engineer mission if he does not first conduct a thorough EBA and then pass that information on to his subordinates. For those that are inexperienced, a planning or preparation checklist outlining what to provide subordinates during each step of the TLPs in the form of a WARNORD, SOEO, and OPORD will lead to better time management and better preparation by those subordinate units.

Captain Quander is a light engineer platoon senior observer/controller. Previous assignments include commander, C/326 Engineer Battalion (Air Assault)—deploying to Afghanistan in support of Operation Enduring Freedom; platoon leader, A/307 Engineer Battalion (Airborne); and assistant brigade engineer, 1st Brigade, 82nd Airborne Division.

Enlisted PERSCOM Notes

By Lieutenant Colonel Jack Smith

On behalf of the staff here in Alexandria, Virginia, greetings from the Engineer Enlisted Branch, Total Army Personnel Command (PERSCOM).

Health of the Regiment

Overall, the Engineer Regiment is very healthy with a major exception of our flagship military occupational specialty (MOS), 12B (combat engineer). Today our Regiment is manned with 16 of 21 MOSs at or above 100 percent, with three more at 99 percent (see Table 1).

Our biggest challenge continues to be the 12B MOS. Manning levels in units throughout the Army have resulted in the addition of this MOS to the Army's top ten critical shortage MOS list. There are several reasons for this. The primary reason is the very low accessions for 12Bs in FY01 and early FY02 in order to decrease the MOS, which at one point reached 111 percent manning levels. This low influx of new combat engineers now has units in the field at or below 90 percent manning for skill level one soldiers. The fix to this problem is already in place. In October 2002, we raised the number of new soldiers that we will recruit into the combat engineer field. It is comforting to know we are taking action to bring manning strengths to appropriate levels; however, we also know that it will take almost a year to get the MOS healthy.

Several actions taken over the past fiscal year have dramatically improved our low density MOSs: 00B (diver), 52E (prime power production specialist), and airborne 62E/J (construction equipment operator). The largest issue for the diver community is the requirement to be diver-certified before being promoted to E5 and E6. The lack of progress in the certification process can slow promotion rates to a crawl. The good news is that the diver community can solve its NCO shortage problems by aggressively pursuing the certification process. The bad news is that we still have many promotion-eligible diver soldiers who are waiting to be certified.

Our prime power community will get healthy this spring with the graduation of the next advanced individual training class. We can fully expect this MOS to come off the Stop Loss Program at that time. Airborne construction equipment operators are always in short supply. These MOSs offer very attractive reclassification bonuses under the Bonus Extension and Retraining (BEAR) Program. Call this office if you are interested in reclassifying into these specialties.

Recruiting and retention have been well above historical averages across the Army and in the Engineer Regiment. Our FY03 recruiting program is at 103 percent, year to date, for the engineer career management fields, and we have recruited 71 percent of FY03s total engineer recruiting mission.

On the reenlistment side, all but one of our 21 specialties is well above the five-year historical trend. Current trends indicate this success rate will continue. Note, however, that in December 2002, a message was published that dramatically decreased the selective reenlistment program for the Army. More than 200 MOSs were removed from the bonus program, and the remaining few experienced decreases in the amount of money in the bonus program.

The long-term projections for the Regiment are very good. We can expect our shortage MOSs (12B10, 00B, and 52E) to improve dramatically in the next 12 months. Meanwhile, other

Engineer Enlisted Operational Strengths*

MOS	Authorized Strength	Strength (percent)
12B	8,161	96
12C	672	103
12Z	234	91
00B	129	102
51B	881	118
51H	433	106
51K	115	103
51M	247	94
51R	127	148
51T	257	127
51Z	116	100
52E	183	89
62E	1,326	103
62F	278	103
62H	102	101
62J	673	105
62N	466	102
81L	233	112
81T	469	100
81Z	19	95
82D	109	110
Total	15,240	98.5

*As of 6 December 2002

Table 1

specialties (51B, 51R, 51T, and 81L) will experience decreases in overall strength to bring them in line with authorized manning levels. The 51R, 51T, and 81L each have some soldiers enrolled in the Fast Track Program, where they are required to reclassify into another MOS due to overstrengths in those particular fields.

Assignment Process

The assignment process is simple:

- The Army defines where soldiers are authorized.
- PERSCOM identifies those authorizations that have no soldiers assigned to them.
- PERSCOM requisitions the branches for soldiers to fill those authorizations.
- An assignment manager goes into the personnel data base and identifies those soldiers who are eligible to fill the requisitions and nominates them to be slotted against those requisitions.
- The nomination process can end with the assignment manager's direct supervisor, depending on the complexity of the assignment, or the process may have to go all the way to the director of the Enlisted Personnel Management Directorate for approval to place a soldier on assignment instructions. In the case of specialty assignments like recruiting and drill sergeant, the files also have to go before administrative boards to ensure that only the best NCOs are slotted into those critical billets.

Now that I have been a part of PERSCOM for six months and have explained the assignment process, I am even more aware of some critical information that needs to be reviewed and updated periodically:

- Unit commanders, first sergeants, battalion S1s and S3s, and personnel managers at all levels must periodically review their modified tables of organization and equipment (MTOEs) or tables of distribution and allowances (TDAs) for completeness. These documents define the authorizations, and it is only these authorizations that can have soldiers requisitioned.
- Unit manning reports are the next important documents. The data in the reports is a direct reflection of what soldier inventory your unit has assigned against its authorizations.

Because I was a company commander for more than three years and a battalion S1, executive officer, and commander, I am familiar with the frustration that arises from trying to manage a unit manning roster. However, I cannot overemphasize that this data must be accurate so PERSCOM will have the opportunity to assign the right person to the right billet.

The most common mistakes in the database include improper grades for enlisted soldiers; soldiers spending an inordinate amount of time with a "gain" code, even after they have been working in a position for months; and soldiers not being placed on a loss roster. Improper grades for your soldiers have the impact of not getting the proper rank structure assigned to your organization. Remember that promotables are counted against the next higher grade for assignment purposes. The loss roster is perhaps the most important data at the unit level. If a soldier is not carried as a loss, the personnel system will never identify a soldier to replace that loss until after the soldier has left. In the case of retirements, this can result in a billet going empty for over 18 months since the unit will not have the soldier available during transition and/or on terminal leave.

In the last PERSCOM Notes, I provided a detailed discussion on how to get your assignment preferences to us. The preferred method is your Army Knowledge Online account. The next best way is to submit a DA Form 4187 *Personnel Action*. Also key is to contact your assignment manager at least every six months. Our Web site, listed at the end of this article, has all the phone numbers and addresses you need. It will have information that can help you make career decisions and set you up for future success in the Army. I highly encourage you to visit our Web page at least monthly. We are updating it every month with information pertinent to the engineer enlisted force. We also have a new site that lists critical billets throughout the Engineer Regiment that most soldiers do not even know exist. If you are an E6, E7, or E8 and are due for a new assignment in the next 8 to 18 months, visit this page on a monthly basis, and contact your assignment manager when you see a billet that piques your interest.

Promotions and Training

There is nothing more frustrating here at PERSCOM than reviewing readiness reports every month that complain about the shortage of NCOs across the Army. At the same time, we see monthly reports that lay out the thousands of soldiers who are eligible for promotion but have not yet been boarded. A look at the engineer star MOSs provides a clear example of how we could solve our own NCO shortages (see Table 2, page 40).

Fully understanding that not all board-eligible soldiers are worthy of consideration for promotion, I also know that most are worthy. The chain of command needs to aggressively pursue the promotion board program. There are thousands of reasons and excuses that make it hard to implement the promotion program, but it has to be done well for our great soldiers in the field. It is usually the combat units, the forward deployed units, and the units in the field that have the hardest times meeting the promotion board process because they are simply working so hard at their missions. But it is exactly these soldiers who deserve the promotions. I will never stop publishing the simple message to all the soldiers in the field. "If your unit

(continued on page 40)

First Lieutenants to Korea: My Experience With the Program

By Captain Chad Suitonu

If you are a new lieutenant in the Army and are dissatisfied with your current assignment—if you're looking for a change and seeking career progression—then Korea could be for you. I went there from my first duty station in October 2000 on the First Lieutenants to Korea Program; was immediately sent to a company executive officer (XO) position in the 2d Engineer Battalion, 2d Infantry Division; and can honestly say that I was pleased with my decision and experience.

The Program

The First Lieutenants to Korea Program is an unofficial Army program that encourages experienced first lieutenants to serve a tour in Korea as company XOs or in staff positions. Because the short overseas tour is a year long, units are losing second lieutenants before they gain the rank and experience needed to fill company XO slots. This leaves most companies without XOs and forces them to assign their most senior second lieutenant to the position. These lieutenants often have limited experience and only serve in the position for a few months until their tours are up.

The target recruits for this program are first lieutenants with 18 to 24 months on station at the time they move to Korea and who will not be promoted to captain during their tour. Korea is considered a hardship tour, and you may wonder why someone would volunteer to participate in such a program. In this article, I share my perspective of the program's advantages.

Make a New Start

One reason for going to Korea is if you are dissatisfied with your current job. As a young second lieutenant, you may make a lot of mistakes. You may go about business incorrectly, gain an unfavorable reputation, or rub someone the wrong way—such as your platoon sergeant or your company commander. As you climb the steep learning curve a new officer faces, you should grow and mature and see the errors of your past ways. It is difficult to make a change to your leadership style and management practices while being part of the same organization and working with the same people. Going to a new place and working in a new organization, with new people, allow you to make a fresh start. You can more freely implement the lessons you learned from your previous assignment. The people who saw you struggle early in your career are not there; there are no looming notions about your shortcomings.

Obtain an XO Position

Another reason to go to Korea is if you want an XO position. If you have done your platoon leader time and want to progress to an XO spot, this program was especially designed for you. Most companies have three to four platoon leaders but only one XO. There could be a long wait at your current duty station for an XO position, and you might not get that opportunity at all but be moved to a staff position, such as assistant battalion S3, instead.

If you plan to take a company command, gaining experience as an XO will help set you up for success as a commander. As a platoon leader, you only see a slice of the company's overall operations. You do not gain the experience of tracking and running supply and maintenance issues at the company level. As an XO, you learn what needs to happen to allow the company to function successfully. You are drawn into the planning process and exposed to company- and battalion-level planning and coordination.

After your tour in Korea, you are automatically slotted for the Captain's Career Course at Fort Leonard Wood, Missouri, which puts you on a fast track. You can serve as little as 18 months at your current duty station, spend a year in Korea, and be at Fort Leonard Wood learning to be a company commander after being in the Army for only about three years.

Learn More and Faster

Korea has a high operating tempo. Things happen fast, and you are always busy and constantly reacting. It is demanding, and you will put in long hours. There is a real-world threat from North Korea, so along with addressing normal operations and training issues, you must deal with periodic alerts and maintain a high state of readiness to be prepared to "fight tonight." There are other complexities that come with working in Korea that enhance your learning experience. For example, there you are constrained by unique rules and procedures. Often you lack adequately trained manpower. It takes much longer to receive supplies ordered from the United States, and land to use for training is scarce. With all of the constraints you deal with and overcome, you become better at managing resources and finding innovative ways to accomplish the mission.

A side benefit of always being busy is that it helps time pass quickly. Everyone I have talked to agrees that although the year in Korea is somewhat difficult, it seems to fly by.

Broaden Your Experience

Going to Korea will broaden your professional and life experiences. This cross-fertilization helps you develop into a more sophisticated and well-rounded officer. Exposure to a new working environment gives you something your peers at their original duty stations will not gain.

Unique to an assignment in Korea is the opportunity to work with Korean Augmentation to U.S. Army soldiers—commonly known as KATUSAs. These Korean nationals live, work, and train with U.S. Army units to supplement manning needs. The assignment provides young officers the opportunity to manage and lead foreign soldiers, gain up-close exposure to a new culture, and address the cultural differences and language barriers.

How to Apply

If you are interested in the First Lieutenants to Korea Program, discuss it with your chain of command. They might be able to develop a solution that satisfies your desires and their needs without your having to make a permanent move. If you and your chain of command decide that going to Korea would be the best solution, call or e-mail your Engineer Branch representative for further details about the program. In my case, I simply submitted a DA Form 4187, *Personnel Action*, signed by my battalion commander, and I had orders a few weeks later.

A Korean assignment is not for everyone, but if you are interested in some of the benefits outlined in this article, it may be what you are looking for. I learned a lot from my participation in the First Lieutenants to Korea Program, and the opportunity for new experiences and professional growth was invaluable.

Captain Suitonu is the G3 (XO), I-Corps, Fort Lewis, Washington. He was previously the XO of C Company, 2d Engineer Battalion, 2d Infantry Division, Republic of Korea. CPT Suitonu is a graduate of the Engineer Captain's Career Course and holds a master's in public policy from the University of Missouri-St. Louis.

(PERSCOM Notes, continued from page 38)

Engineer STAR MOSs			
MOS	Rank	Number Needed	Number Eligible
00B	SSG	22	26
51K	SGT	7	31
51M	SGT	13	51
51M	SSG	19	26

Table 2

has you working or assigned to a billet that requires the next higher grade, go to your first sergeant and/or command sergeant major and request to be put before the next board if you are eligible." If the chain of command wants to work you at the next higher paygrade, then get promoted and paid for the level of responsibility that they are demanding of you.

Conditional promotions have been on the street for some time, but they require attendance in the requisite Noncommissioned Officer Education System (NCOES) course (Primary Leader Development Course, Basic and Advanced Noncommissioned Officer's Courses) within one year of the conditional promotion. Failure to meet this requirement can result in a demotion. There are exceptions to policy for operational and hardship reasons; however, it is imperative that the soldiers attend the NCOES courses as soon as possible. Do not hesitate to contact this office if you have questions about NCOES attendance or conditional promotions.

For information on pending selection boards, visit the PERSCOM Web site *(www.perscomonline.army.mil)* for the latest news. It's up to you to review your Official Military Personnel File. You can obtain a copy by following the procedures posted at the PERSCOM Web site.

Contacting Us

The sole function of Engineer Branch is to support soldiers and commanders in the field. I encourage you to contact your assignment manager, professional development NCO, branch sergeant major, or me with any questions you have about assignments or professional development. The PERSCOM Web site has information on how to reach us. Remember, the only thing in the assignment process that does not have to be a variable is your preference. Take the time to let us know your preference.

Assignment Opportunities in the Far East District, U.S. Army Corps of Engineers

By Major Richard T. Byrd, Jr., and Sergeant First Class Carl L. Lindsay II

Military assignments in Korea are many and varied. Among them are opportunities for active duty Army engineers to serve in the U.S. Army Corps of Engineers (USACE) Far East District (FED). Both noncommissioned and commissioned officers can serve here. This article describes two possible assignments—that of project engineer and construction inspector.

Project Engineer

Most officers assigned to the FED come through the Advanced Civil Schooling Program. This is usually an 18-month program in a specified engineering discipline or in construction management. (See the engineer Web site for more information: *https://www.perscomonline.army.mil/OPeng/advanced_civil_schooling.htm*).

Another way to be eligible is to already have your master's, perhaps through the University of Missouri-Rolla program at the U.S. Army Maneuver Support Center, Fort Leonard Wood, Missouri, or through the Degree Completion Program. You must also have completed a successful company command. If assigned to the FED, you will have the option of serving in a two-year command-sponsored tour or a one-year non-command-sponsored tour. If you select a one-year tour, then you will return to the states to complete your three-year commitment to the Corps. Currently there are seven engineer officer positions authorized at the FED, two of which are the commander and deputy commander.

As a captain or major you will probably be assigned as a project engineer, working in one of six resident or project offices. Project engineers serve in a position similar to an area construction manager in a civilian construction company. You will supervise civilian quality assurance representatives whose responsibility is projects ranging in cost from thousands to multimillion dollar contracts. Your job as a project engineer will include several types of contracts, to include military construction and host-nation-funded projects. The FED supports the United States Forces Korea (USFK), and therefore, our customers cover every service component and other agencies such as the Army and Air Force Exchange Service and Department of Defense Dependents' Schools.

Some of your responsibilities as a project engineer will include—

- Verifying and processing contractor payment applications.
- Visiting project sites to monitor safety, quality, and progress.
- Corresponding with contractors and customers.
- Interpreting contract drawings and specifications.
- Attending periodic progress meetings with contractors.
- Managing quality assurance representatives.
- Being involved in military exercises.

As a project engineer, you will also be appointed as a contracting officer's representative. This gives you the authority to administer contracts and direct contractors as they execute projects.

This job is an excellent opportunity to use your engineering skills/education that you may not have exercised in most troop units. You will manage projects of varying scope—from dining facilities and fire stations to barracks upgrades and airfield runway pavements. In managing these projects, you will interface with contractors, customers, facility users, Directorate of Public Works personnel, base civil engineer personnel from the Air Force, and a variety of other people involved in the construction process. This also includes a large USACE team. The FED maintains a staff of technical experts—to include designers and mechanical, civil, electrical, architectural, structural, environmental, and geotechnical engineers. You can also "reach back" to USACE labs, Centers of Expertise, or any other USACE district for assistance if you need to. So, although you may not have much experience in construction, you are surrounded by other people who do. It's just like being a platoon leader again; if you're smart, you keep quiet and listen to your NCOs. The same principle applies here; you listen and learn from those around you with the experience, and you'll be up and running in no time. The learning curve is initially steep, but you will catch on quickly and be on your way to being a successful project engineer.

Another responsibility you will have is working with the service components in Korea during contingencies. As the only USACE maneuver district, we have the added task of assisting with the development and maintenance of the contingency construction list—a list of construction projects to be executed in the event of a contingency. The major work for this list occurs during two exercises held each year: Ulchi Focus Lens and Reception, Staging, Onward Movement, and Integration. The FED provides liaison officers or teams to each service component, USFK, and the Republic of Korea army during these exercises. The entire FED team—as well as reach-back capabilities to the Centers of Expertise in the states—is utilized during these exercises.

Other duties during contingencies for military members include leading facility damage assessment teams, performing staff officer duties, or deploying as a member of a deployable forward engineer support team-advance (FEST-A) as part of the USACE field force engineering doctrine.

Construction Inspector

Noncommissioned officers assigned to the FED as construction inspectors are usually staff sergeants who have completed their squad leader time and are close to promotion to sergeant first class with military occupational specialty (MOS) 51H, construction engineer. Construction inspectors work for a project engineer and are delegated authority and responsibility to monitor and administer the contractual provisions for assigned projects.

About 10 percent of your time will be spent on—

- Reviewing plans and specifications during the design and/or bidding phase, paying special attention to existing field conditions.
- Preparing comments for possible changes to plans and specifications.

About 80 percent of your time will be spent on—

- Monitoring on-site contractor supervision and inspection of construction activities.
- Ensuring that construction quality is achieved by enforcing the quality control provisions of the contract. This includes ensuring that the contractor's field staff makes periodic inspections and tests.
- Reviewing and evaluating construction progress, quality assurance findings, and recommended field and office engineering changes for consistency with contractual provisions, specifications, and cost estimates.
- Discussing problems and recommendations with the project engineer and providing input for solutions or courses of action based on knowledge and experience with the contract and from observations made at project sites.
- Reviewing the contractor's construction schedules, safety program, and quality control plan and initiating field changes.

A project engineer inspects a standing seam metal roof.

A construction inspector checks roofing materials.

- Informing the project engineer of progress and other significant contract administrations.
- Ensuring that contractor as-built drawings are kept up to date.
- Participating in joint occupancy and final transfer inspections.
- Furnishing field information for construction progress and feeder information for other reports.

About 10 percent of your time will be spent on—

- Enforcing the project safety program.
- Supervising the contractor's efforts in the implementation of Engineer Manual 385-1-1, *Safety and Health Requirements*.

There are also exercises that the FED participates in that transition the soldier from the duties of construction inspector to those of a liaison officer for one of the service components. In this, you help the component complete the contingency construction list by offering the design and construction services the FED has as well as the ability to "reach back" for a vast amount of technical information. In addition, there are the daily soldier duties of physical fitness training, weapons qualification, etc.

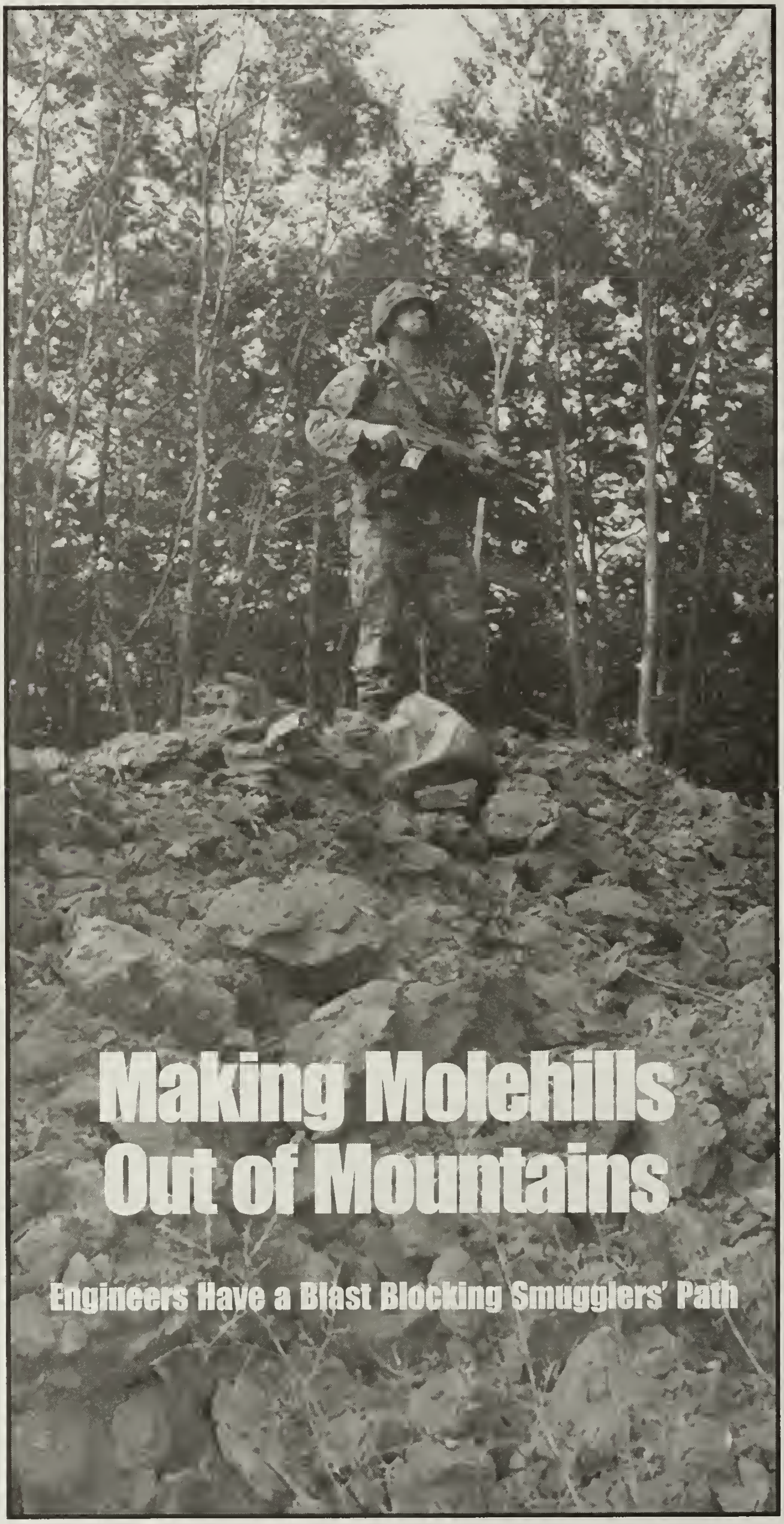
This assignment is definitely a career-enhancing assignment. The number of construction projects, methods, and techniques that NCOs will be exposed to during an assignment with the FED is unequalled in the average Army construction engineer's NCO career.

Conclusion

If you come to Korea with the right attitude and are willing to learn, you'll have a great tour. Things have changed since some of you were here. The commander has really worked hard to improve the quality of life all around the peninsula. Not only does this equate to more work for USACE but also to a better way of life for all of us here. This job is definitely unique and, no, you are not stuck behind a desk all day. Getting out and seeing the construction projects allows you to experience new things every day. It is a very rewarding assignment, knowing that you play a major role in improving the quality of life for all service members in Korea.

Major Byrd received a master's in construction management from the University of Oklahoma through the Army's Advanced Civil Schooling Program before serving two years with the Far East District of the U.S. Army Corps of Engineers as a project engineer in the Central Resident Office at Osan Air Base, Korea. He is currently a staff officer for the 8th Army Engineers, Korea. MAJ Byrd's next assignment will be the Command and General Staff College at Fort Leavenworth, Kansas.

Sergeant First Class Lindsay was a construction inspector with the Far East District of the U.S. Army Corps of Engineers when this article was written. He is currently the platoon sergeant of 1st Platoon, Alpha Company, 46th Engineer Battalion, Fort Polk, Louisiana. SFC Lindsay holds an associate in general studies and is working on a bachelor's in business and management.



Making Molehills Out of Mountains

Engineers Have a Blast Blocking Smugglers' Path

By Specialist Patrick Rodriguez

At Camp Monteith, Kosovo, the day ended not with a bang or whimper but with a tremendous thud that echoed through the valley. That morning, Task Force 9th Engineer Battalion had departed from the camp to blow up a suspected smuggling route crossing into the Former Yugoslavian Republic of Macedonia from Kosovo. The day began 16 hours before the last explosion, with the high-mobility, multipurpose wheeled vehicles (HMMWVs) crisscrossing up and into the mountains. The route soon became more of a footpath than a vehicle trail. Still, there was evidence that the trail had been used: scarred trees, discarded water bottles, and tire tracks.

First, the task force had to pick a site, which would depend on existing obstacles and terrain in the area. It would be best to link this access to a very steep slope on either side of the road. The site the task force chose was a trail in the German sector of Multinational Brigade (East) with steep slopes on both sides near the top of a densely wooded slope. There was some economic smuggling along the administrative boundary line that separates Kosovo from other provinces in the Federal Republic of Yugoslavia—tax avoidance stuff—but here, the problem was support to armed elements. The task force wanted to stop the smuggling of weapons and the support of ethnic armed groups on either side of the border.

The plan was to set off two explosions—the first from shaped charges and the second from cratering charges. Shaped charges, made of composition B explosives, will go through reinforced concrete and cut through steel. Inside the charge is a cone, and when it detonates, it detonates from the top and consumes itself. By the time it comes out the bottom, it's just a ball of plasma. It pushes everything out of the way. Shaped charges are set a couple of feet off the ground for optimum penetration. These charges would create six boreholes, which would be used for the larger, more robust cratering charges (made of composition H6).

But before destroying the smuggling route, the task force had a few tasks to complete that consumed most of the day:

- Phase 1 consisted of clearing the brush. The team hacked unmercifully for hours at the trees and bushes on both sides of the trail to provide a view of the explosions from both the shaped and cratering charges.
- Phases 2 and 3 consisted of preparing the explosives and setting them off.

The task force ensured that the U.S. and German soldiers who had been providing security for the platoon had evacuated the area after the shaped charges were placed the required distance above the sloped trail. From several hundred feet away, in the protective cocoon of an armored HMMWV, the demolition team set off the first explosion. It ripped through the valley and was felt more than half a mile away.

Soldiers duel-prime a 40-pound cratering charge with the use of composition B explosives.

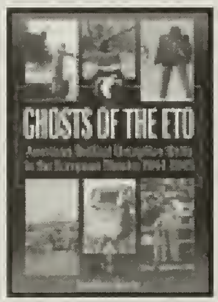
Moments later, the task force returned to the site of the explosion. The ground was covered with green leaves from the trees overhead, and the site smelled like fresh-cut grass. Five of the six charges had cleared holes straight into the ground. One of the charges hit a large rock on the way down and stopped a few feet short of the desired depth. After examining all six boreholes, the task force dug the holes so they were wide and deep enough for the cratering charges. Then, the cratering charges were put in place and detonated. The explosion rocked the mountainside and flung the trail skyward, including trees, gravel, dirt, and large rocks. Debris rained down on the HMMWV with loud bangs. This time, when the team returned to the site, it smelled like tilled earth.

A soldier primes a 40-pound shaped charge with a blasting cap crimped to detonating cord.

The "tank ditch" was such a success that the Task Force 9th Engineer Battalion worried that if smugglers came at night, they would be injured if they fell into the ditch. So the final touches to the 18-wheeler-size gouge across the trail were strands of concertina wire that led off the trail and down the steep slopes on both sides of the barrier.

Specialist Rodriguez is a journalist/photojournalist with the 302d Mobile Public Affairs Detachment, Camp Monteith, Kosovo.

Book Review



Ghosts of the ETO, American Tactical Deception Units in the European Theatre of Operations, 1944-1945, by Jonathon Gawne. Published by CASEMAT (Havertown, Pennsylvania) 2002, 342 pages, more than 100 photos. The ISBN is 0-9711709-5-9 for a hardback ($34.95).

For more than 50 years, a veil of secrecy lay over the role of tactical deception employed by the U.S. Army in the European Theatre of Operations (ETO) in World War II. This veil was lifted during 1996, when information was declassified regarding these deception operations and the Army organization that—for the first time in the history of warfare—was created to execute tactical deception operations as its full-time mission.

In an important new book, *Ghosts of the ETO*, author Jonathon Gawne chronicles the formation and activities of the U.S. Army's 23d Special Troops and credits its wartime deception operations with saving American lives and contributing to the Allied victory. In revealing the 23d's World War II activities, Gawne analyzes the role and importance of tactical deception and—in light of the Army's "deactivation" of a formalized deception capability following World War II—points to the need for the Army to revive tactical deception as a necessary tool for waging war.

Gawne identifies the two features that made the 23d a unique organization: One, it was the first organization in the history of warfare that was organized and dedicated to conducting tactical deception on a continuing basis. In the past, the great commanders—including Napoleon, Caesar, Hannibal and Lee—conducted deception operations on an *ad hoc* basis. They employed all or a portion of their troops in a deception operation, and when this operation was completed, the troops returned to their normal fighting roles. For the 23d, tactical deception was its sole mission. The organization was, in effect, a military traveling road show. It would perform its deception act in one location, and when the operation was completed, it would move on to another location and perform a similar or different act. At times, its units performed simultaneously in different locations.

Two, the organization raised tactical deception to a highly sophisticated, full-spectrum level. It was able to reproduce the "sights and sounds" of the various units and headquarters of a field army.

Gawne has written a fascinating, thoroughly researched, well-documented, and very readable account of this unique organization, covering the "what, where, when, how, and why." He describes its genesis and its activation as well as its "growing pains." He also describes, analyzes, and evaluates each of the 21 major deception operations, culminating with the 1945 crossing of the Rhine River. For each operation, he gives the "big picture" as well as a "nuts-and-bolts" account of what happened. Each deception plan has a battle sketch to facilitate easy understanding of the concept of operation. And an understanding of the tools of deception is enhanced by the inclusion of many photographs.

This new concept of tactical deception originated in the ETO as a result of a study initiated by General Devers, then the commanding general, which analyzed Field Marshal Montgomery's use of deception at the battle of El Alemein. General Devers submitted a request to the War Department for a unit to be authorized, organized, and dedicated to tactical deception, with the capability of simulating two infantry divisions and one armor division for the crossing of the Rhine River. This request was approved, giving birth to the 23d Special Troops.

The 23d consisted of a headquarters, a headquarters company, and four line units—two of which were engineer units:

- An engineer camouflage battalion to provide inflatable dummy tanks, trucks, artillery pieces, and other types of vehicles and equipment as well as to operate flash devices replicating the flash of artillery firing.
- An engineer combat company to provide perimeter security against enemy forces as well as local security against enemy agents and the local populace; conduct mine clearing; execute construction and demolition tasks, including digging tank and artillery positions; and simulate tank tracks by using bulldozers.
- A signal company to transmit false radio messages.
- A sonic company equipped with half-tracks and loudspeakers to reproduce sounds such as tanks on the move, assault boats in action, and bridging operations.

The 23d was activated at Camp Forrest, Tennessee, on 20 January 1944, with an eventual strength of 82 officers and 1,023 enlisted men. In the beginning, there was no guidance, no doctrine, no manuals, and no SOPs. Throughout most of the life of the organization, it was a matter of learning by trial and error—a large part of which occurred on the battlefield.

The organization's first mission was a small operation called Troutfly. A lieutenant and 13 radiomen landed in Normandy on D+3. The original plan was aborted, and the detachment became the 82d Airborne Division's main means of radio communications. The division had lost almost 95 percent of its radio equipment on D-Day.

The 23d participated in 21 major deception operations and several smaller ones that extended from Normandy to Brittany and Brest, through the rest of northern France, Holland, Belgium, Luxembourg, and Germany to the Rhine River and involved most of the divisions, corps, and armies.

By the time of the Rhine crossing, the 23d Special Troops was a seasoned organization, having learned its lessons well. And senior headquarters had gained an appreciation for deception and how to properly utilize the capabilities of the unit.

Some important lessons learned along the way include the following:

- There was a lack of knowledge of deception and appreciation for its value on the part of many commanders. Some showed little interest in employing deception, others used deception only halfheartedly, while others misused it.
- Close and continuous coordination of the deception operation with other aspects of the tactical plan was vital to success. In an attack at Brest, the maneuver plan was changed at the eleventh hour to have the main attack pass through the area where a deception buildup of forces had been portrayed. With the Germans in waiting, unnecessary casualties were sustained and tanks destroyed.
- The use of "special effects" was not considered during training in the United States. However, once the organization initiated operations, special effects became an important means of

completing the deception picture. Special effects involved the identifying features of the simulated units, such as shoulder patches, bumper markings, and command post signs. While the 23d units wore and displayed these identifying features, the simulated units were required to black out and remove their own identifying features. Special effects assumed progressively greater importance as the German aerial observation capabilities decreased, and the enemy placed increased reliance on ground observation for intelligence information.

- Tight local security was needed to prevent enemy agents and the local populace from observing certain aspects of a deception operation, especially the dummy equipment.
- It was not only necessary to deceive the enemy and the local populace but also to deceive *our own* troops to maintain secrecy of the deception operations. Enter another phase of playacting; scripts outlining the simulated unit's organization, recent activities, and current officers were given to the soldiers. Ad libbing was often required to satisfy incredulous officers and enlisted men as well as to carry on conversations with the local populace.
- Probably the most important lesson learned was the necessity for strict discipline and attention to detail during the planning and execution phases of a deception operation. Failure to do so could easily compromise an operation. Enemy intelligence was continuously on the lookout for operational irregularities and mistakes.

The crossing of the Rhine—known as Operation Viersen—was a classic deception operation, executed the way deception should be executed. The staff member of the 23d who masterminded the deception operation portion of the tactical plan was stationed in the Ninth Army G3 section to work closely with all elements of the Army staff and to monitor the execution of the deception operation. Consequently, the operation carried the full authority of General Simpson, the Army commander, resulting in the development and execution of detailed plans at all subordinate levels. In this operation, the 23d simulated—with all of its sights and sounds—the 30th and 79th Divisions. These simulated divisions were deployed in the center of the army sector with the mission of feigning the main attack on 1 April. To fill out the deception picture, as happened in some of its previous deception operations, the 23d was augmented with real units—in this case there were infantry, engineer, antiaircraft artillery, field artillery, and tank units. When the two real divisions attacked to the north, crossing the Rhine in the vicinity of Wesel on 26 March, they suffered only 31 casualties. This extremely low casualty figure was considered a remarkable achievement in view of the fact that the Rhine was a major barrier defended by a determined enemy and constituted the last barrier to entry into the heartland of Germany. In a letter of commendation to the 23d, General Simpson recognized its considerable contribution.

While the 23d participated in a few deception operations that were aborted, some that were of uncertain success, and others that were quite successful, the overall performance of the organization in these operations was judged as excellent. A measure of the real contribution of the 23d to the winning of the war was not in the number of Germans killed but rather in the many thousands of American lives that were spared.

In summary, *Ghosts of the ETO* is an excellent, balanced history of the 23d Special Troops. Gawne tells the story like it was—warts and all. I say this because I was there as commander of the 406th Engineer Combat Company.

Besides telling the story of the 23d, the book is important for another reason. To date, no book written about the war in the ETO has included the participation and impact of the 23d's effort on the outcome of the tactical plans of divisions, corps, or armies. This is understandable since the activities of the 23d were only recently declassified. In the future, such books should include a discussion of the organization's participation and an evaluation of its contribution to the outcome of the tactical plans in order to provide a complete story of what occurred. For the same reason, sections of many books already written about the battles in the ETO should be rewritten. This book is an excellent starting point for researching this new dimension in many of the ETO battles. In addition, many of the Army's field manuals need to be rewritten to incorporate the deception doctrine and techniques developed by the 23d, but they should be updated for the 21st century.

Gawne also addresses, in a limited way, the future of deception. He suggests that—building on the 23d's World War II experiences—new equipment, doctrine, etc., need to be developed that incorporate the latest technology. I venture to add the following comments:

With this "Everything-You-Ever-Wanted-to-Know-About-Tactical-Deception" book now on the market, it is fair to assume that at least all of the major foreign armies, intelligence agencies, and military schools will buy the book to learn about the sophisticated use of deception as developed by the Army in the ETO during World War II. With this background, foreign armies may do at least three things:

- Direct their intelligence agencies to ensure that they have the capability of gathering information on the full spectrum of the sights and sounds of the U.S. Army.
- Develop their own tactical deception units to operate on a continuing basis.
- Emphasize the teaching of deception in their service schools so that officers and noncommissioned officers at all levels are knowledgeable in the art.

What must the U.S. Army do? It must build on the solid foundation of the battlefield knowledge the 23d Special Troops gained in World War II and move forward by taking advantage of the latest technology and military thinking. To do this, the Army should establish a full-time organization to continuously study tactical deception with the goal of developing doctrine, materiel, etc., appropriate for future warfare. This organization should be charged with—

- Developing criteria, requirements, and funding for research and development of new, advanced tactical deception equipment.
- Developing doctrine, procedures, techniques, tables of organization and equipment, SOPs, etc., appropriate for the employment of a self-contained tactical deception unit.
- Ensuring that our intelligence agencies are devoting sufficient resources toward determining the enemy's means of intelligence gathering so that ways can be developed to neutralize, counter, or turn these means to our advantage.
- Ensuring that tactical deception is emphasized in its various aspects in the curricula of all of our service schools. Gawne's book should be a part of the course material.

The end product of these activities is a self-contained organization that is dedicated to tactical deception operations on a continuing basis and is operational at the outbreak of hostilities.

The U.S. Army Training and Doctrine Command should incorporate tactical deception in future organizations and training, to include all service schools.

Based on the above discussion, there is reason to believe that *Ghosts of the ETO* may be one of the most important books to come out of World War II. It should be read by all officers from the highest to lowest rank and by all noncommissioned officers.

Reviewed by Major General George A. Rebh (Retired). In addition to commanding the 406th Engineer Combat Company, ETO, he served in various units, U.S. Army Corps of Engineer Districts, and Chief of Engineers positions during his 32-year military career. He is a graduate of the U.S. Military Academy and was a Rhodes scholar.

Live Fire . . . Heavy

By Captain Alexander J. Buehler

Thunderbase, this is Metal 36. Adjust fire, over . . . BMP in the open . . . Dustoff 6, this is Metal 36 . . . I have three casualties, two ambulatory and one KIA. Similar radio transmissions echoed over the Wolverine network for ten intense days during the 94th Engineer Battalion (Combat) (Heavy) live-fire exercise—called Protective Wolverine—at Grafenwoehr training area in Germany.

The concept of such an exercise was foreign to the construction engineers of the 94th, which is assigned to the 130th Engineer Brigade. Even the most seasoned Wolverine soldiers, having spent more than five years in the organization, could not recall an event that was remotely similar. The genesis occurred more than ten months before, when the operations officer pitched a concept at the annual training strategy seminar. His suspicion, which included a perceived shortcoming in basic combat skills and a lack of confidence in weapons employment, was confirmed by the reaction of the officers and senior noncommissioned officers in the audience. The support for the live-fire concept was overwhelming, and Exercise Protective Wolverine steadily progressed from a concept sketch to a deliberate plan.

The Intent

The battalion commander's intent for the exercise was clear: prepare the leaders and soldiers of the battalion to respond to enemy contact, employ organic and nonorganic weapons systems, and survive and carry on with the construction mission. The overarching objective was to preserve and prolong the battalion's ability to construct in potentially hostile situations.

An additional aim was to define a model for leaders in the battalion to plan, resource, and execute large-scale training exercises according to the deliberate eight-step training process (see article " Cobra Gold '99 Tests the Eight-Step Training Model," *Engineer*, April 2000). The commander also quantified success for this exercise. Leaders would become more comfortable with making command decisions in a highly stressful environment. Furthermore, they would cultivate an appreciation for the fog of battle and understand its impact on deliberate planning. Most importantly, however, individuals would walk away from the exercise as better soldiers—more confident in basic tactics, more adept at integrating and synchronizing weapons systems, and more competent as construction engineers and warfighters. Finally, the commander specified one standard for implementation: safe execution with deliberate risk management.

The Plan

The S3 launched the military decision-making process, while the executive officer (XO) set the wheels in motion to stand up a responsive support network for the exercise. The plan was exhaustive with many considerations. The S3 synchronized a complex and expansive execution matrix, published all pertinent orders, specified evaluation criteria in painstaking detail, resourced and scripted the scenarios, mastered the muddled bureaucracy of range control, coordinated for all external resources, and developed a thorough plan to ensure preparedness for the exercise.

Such planning seems somewhat routine in the absence of external constraints; however, it was the indelible presence of these constraints, which were abundant and ever changing, that brought challenge to the planning and pliability to the execution. Limitations included no heavy fire on German holidays or after 0200 hours and narrow windows of opportunity for air medical evacuation (MEDEVAC) and C-130 overflights. Adaptation would be paramount.

In addition to planning the training, the S3 devised a notional operations order with a uniquely realistic enemy situation. All elements of the exercise were crafted to fit neatly into the big picture. The scenario was a coalition army fighting westward, leaving bypassed units and special-purpose forces in the battalion sector. Generally operating in 12-man teams, the forces would seek to impede construction operations, harass Wolverine soldiers, and disrupt logistical supply centers.

Concurrent with the diligent preparations of the S3, the XO harnessed the staff energy to cement a support cell. The burden of support was deliberately withheld from the unit level. All commanders would focus purely on combat training and safe execution. The "beans and bullets" would be left up to the battalion. This included a feeding plan with two separate mess operations along with Class I logistics trains, which allowed feeding downrange to reduce time in transit.

Additionally, the XO—along with the S4—planned the largest ammunition receipt, storage, and distribution plan in battalion history. Notwithstanding a major Class I and Class V push, the XO considered all details—no matter how trivial—and integrated them into the overall support network. The companies would not need to consider sustainment of their soldiers.

The platoon synchronized direct and indirect fire to suppress the enemy and then removed casualties via air MEDEVAC.

The Method

Exercise Protective Wolverine was not only a live-fire exercise, but it was also a platoon-level external evaluation. First, companies deployed from home station, conducted a convoy, and occupied a tactical assembly area, all of which were critically observed by observer-controller-evaluators (OCEs). Next, platoons cycled through a casualty evaluation, treatment, and evacuation (CETE) lane, training with battalion medics and air MEDEVAC personnel to perfect these skills before game day.

After successful validation of the CETE training, platoons proceeded through a fire-maneuver (F-M) lane, which focused on movement under direct fire, weapons discipline, and the initiation and control of fire. After a two-day hiatus for internal training, the platoon began the first of two capstone exercises, the convoy ambush lane. Conducting a tactical convoy en route to a construction site, the platoon was confronted with an enemy ambush. A complex blocking obstacle (a wire/mine configuration), a BMP in the open, and enemy soldiers to the front combined to intensify the complexity of the scenario and place an uncomfortable level of stress on the platoon leadership.

Platoons integrated and massed fire, called for 120-millimeter-mortar indirect fire, and ultimately removed casualties via air MEDEVAC. The "crawl-walk-run" training strategy was necessary to facilitate safe execution on the lane. After a crawl led by the OCEs, the platoon validated a daytime blank iteration—or walk phase—before the run phase, which added live ammunition to the training.

The platoon carries on with the construction mission.

Subsequently, platoons validated a nighttime blank iteration before the night run phase. The minimum number of iterations for this lane was five, assuming that platoons validated both blank iterations on the first try.

After the convoy ambush lane, the platoon progressed to the culminating event—the jobsite security lane. During this lane, the platoon conducted a tactical convoy to the jobsite, occupied the area, established jobsite security, initiated construction operations, and—upon enemy contact—suppressed and reduced the threat. Similar to the convoy ambush lane, the platoon synchronized direct and indirect fire to suppress the enemy and then removed casualties via air MEDEVAC. Likewise, OCEs implemented an identical crawl-walk-run methodology. Unlike the convoy ambush lane, the platoon installed, tested, and fired claymore mines as part of the validation. Finally, after successful completion of four lanes—CETE, F-M, convoy ambush, and jobsite security—companies regrouped, consolidated, and redeployed to their home station.

Exercise Protective Wolverine provided training for platoons, but the aforementioned summary does little to capture the training that occurred behind the scenes. Companies conducted extensive training before the exercise, and all officers attended a call-for-fire class at the Combined Arms Training Center at their home station in Vilseck, Germany. Additionally, all OCEs underwent an incremental train-up session and became validated on their lanes before their first iteration.

OCE teams were composed of six personnel from various backgrounds to maximize the collective experience and overall effectiveness of the team, and they adhered to a day-on, day-off schedule to maintain focus. As any veteran officer in charge (OIC) can attest, running a range on the Grafenwoehr training area is no simple undertaking. Throughout the 15-day Protective Wolverine exercise, the 94th Engineer Battalion occupied Range 117, managed an ammunition holding area on-site, survived numerous "courtesy" inspections from range control, and turned over the range and facilities without a hitch. Two officers worked alternating 24-hour shifts, manning the Range 117 tower. Several FM radios, two main frequencies, two Motorola frequencies, and two fixed lines combined to create a unique command and control challenge, but the tower OICs met the challenge head-on. Range control expressed ongoing approval for the exercise at large.

The numbers speak volumes regarding the intensity and complexity of the exercise. Ammunition expenditures included ninety thousand 5.56-millimeter rounds; ninety 81-millimeter illumination rounds; one hundred forty-four 120-millimeter high-explosive rounds; thirty M18A1 claymore mines; and an abundance of simulators, smoke grenades, and pyrotechnics. Black Hawk pilots logged more than fifty MEDEVAC flights in support of the operation. The live fire was . . . heavy.

The Aftermath

As platoons and companies redeployed, Range 117 was cleared and turned over. One resounding afterthought remained: the exercise was excellent, and the commander's intent was met. A value-added aspect of the exercise, which exceeded the commander's intent, involved the intangible team building that underlined the training. As leaders and soldiers prepare for upcoming construction missions in Africa, Poland, and Germany, they go forth with more confidence and proficiency, knowing full well that—in the event of hostile aggression—they are better prepared to survive the threat and carry on with their construction missions. And as for the organization, the 94th Engineer Battalion proved that combat heavy engineers can safely and effectively conduct a live-fire exercise and . . . the fire tends to be heavy.

Captain Buehler was the S4 of the 94th Engineer Battalion (Combat) (Heavy), 10th Engineer Brigade, Vilseck, Germany, when this article was written. He has since left the Army and is attending the Wharton School of Business at the University of Pennsylvania. His previous assignments include civil engineer for the 94th Engineer Battalion, where he deployed to Kosovo and Albania, and platoon leader, Task Force Able Sentry, Skopje, Macedonia. He is a graduate of the U.S. Military Academy, the Engineer Officer Basic Course, and airborne and air assault schools.

Washington—Engineer and Engineer Advocate

By Major John Richard Boulé II

George Washington was a great early American engineer. Hundreds of books have been written about his accomplishments as a Virginia planter, a military commander, a noble statesmen, and a symbol for the new American nation. Although Washington's surveying achievements are fairly well publicized, almost nothing has been written about Washington the engineer and engineer advocate. In this article, I will show that the father of our country was an accomplished engineer who served as a strong proponent for establishing American engineering institutions.

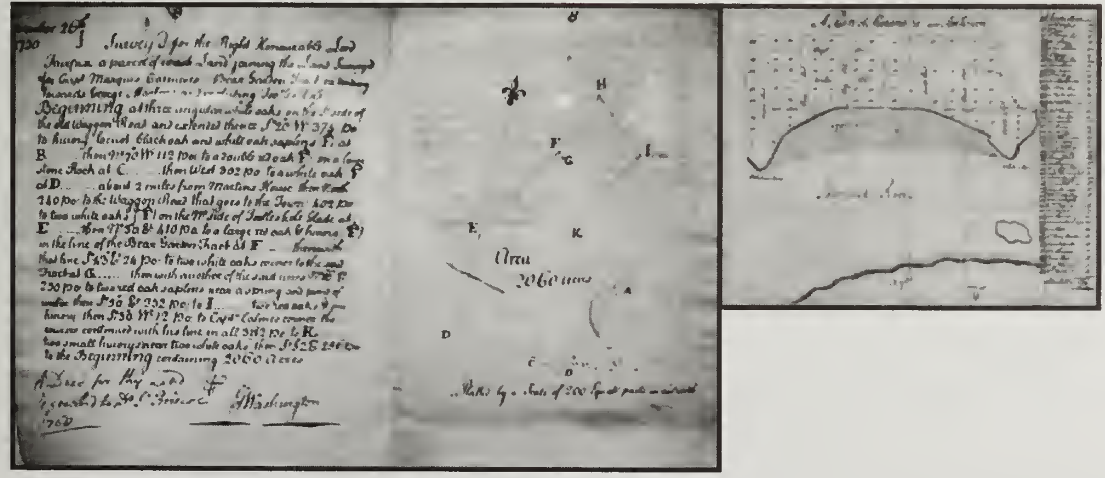
George Washington did not have a formal education. However, from the time he was a young man, he engaged in engineering activities. As he continued to mature, the same skills that made him a good surveyor, builder, and innovator were applied to other pursuits. These talents and experiences formed the solid foundation upon which Washington built his more notable achievements, much the way that Lee and MacArthur applied their engineering backgrounds to become two of the greatest American practitioners of operational art. As you will see, it is time to add Washington to the long list of great American engineers.

Defining Engineers

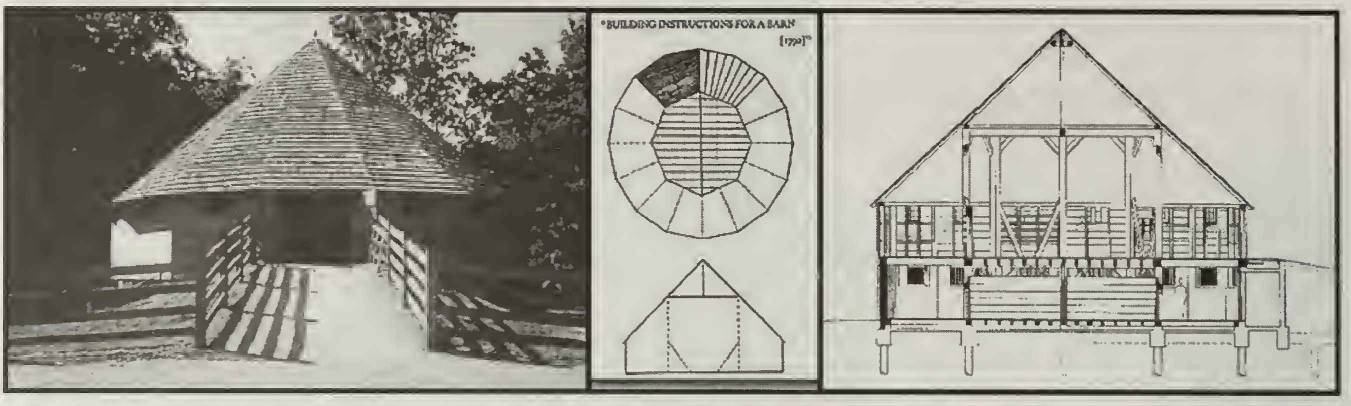
Engineers have been labeled as professionals who apply math and science to create something of value[1]—a rather mundane definition. Theodore Von Karman, an aerospace engineer, put it differently. "Scientists discover the world that exists; *engineers create the world that never was.*"[2] This definition fits Washington. In many ways, he was indispensable in creating a world that had not existed in his time. He did this on a grand scale in his efforts as commander of the Continental Army and first President of the United States. He also did it on a smaller scale in Virginia as a surveyor, planter, businessman, and gentleman. Washington created through natural talent, devotion, resoluteness, and hard work.

Engineers throughout history have used this formula for success. Rudyard Kipling recognized these traits when he wrote *Sons of Martha*, his ode to engineers. His ode defends Martha's comment to Jesus about her sister Mary (Luke 10:42). In Kipling's poem, now adopted as the poem for engineers, he writes:

> *"The Sons of Mary seldom bother, for they have inherited the good part; But the Sons of Martha favour their Mother of the careful soul and the troubled heart...They say to the mountains, 'Be ye removed.' They say to the floods, 'Be dry.' Under their rods are the rocks reproved—they are not afraid of that which is high. Then do the hilltops shake to the summit–then is the bed of the deep laid bare, That the Sons of Mary may overcome it, pleasantly sleeping and unaware."*[3]



A survey, commissioned by Lord Fairfax, and a map of Alexandria, Virginia, were done by George Washington.



Washington's grain-threshing structure was rebuilt at Mount Vernon. He created these plans while President of the United States.

Washington was definitely a Son of Martha. He fearlessly persevered through many daunting challenges until he prevailed. Virginians, and later all Americans, benefited from his efforts.

Engineering in Washington's Time

Washington lived most of his life before the advent of the Industrial Revolution. Engineering, as we classify it today, did not exist in his day. Although colleges like Harvard and Columbia (then called King's College) operated in the colonies, America did not have a school where formal engineering skills were taught. In Europe, engineering instruction often focused on fortifications and siege craft. Even the Great Wall of China, finished in 1640, was barely 100 years old when Washington was born!

It is safe to say that American engineering was in its infancy during Washington's time. The first engineered structure in America, the Castillo de San Marcos, was designed and constructed in Florida in 1695, only 37 years before Washington's birth.[4] Some of the most famous engineering projects completed during Washington's time were the first municipal pumped waterworks in Bethlehem, Pennsylvania, in 1755, and the survey of the Mason-Dixon line, officially designating the Pennsylvania-Virginia boundary, in 1767. Engineers were not even legally recognized as experts in America until 1782, one year before the Revolutionary War concluded.[5] Therefore, we cannot expect Washington to be involved in *major* engineering projects; they simply did not exist. Likewise, we cannot consider him an engineer unless he demonstrated some engineering credentials.

Washington, Engineering Qualifications

As a young man, Washington learned to survey. He had a natural talent for mathematics. At the age of 16, he apprenticed with several accomplished surveyors on a month-long trip to the Blue Ridge Mountains to survey Lord Fairfax's lands.[6] He mastered the trade quickly, earning an appointment as county surveyor of Culpeper County, Virginia, at the age of 17.

Washington later used his knowledge of topography and mapmaking to produce drawings of the Ohio River Valley in 1753, while on a dangerous mission to deliver a message to the French demanding their withdrawal from the region. These sketches represented the state of geographical knowledge of the area at the outbreak of the French and Indian War that occurred shortly after his trip.[7]

Even though he was heavily burdened as a Virginia planter, businessman, and legislator; commander of the Continental Army for eight years; and President of the United States for eight years, he is credited with conducting an extensive number of surveys. During his lifetime, Washington surveyed more than 200 tracts of land consisting of 60,000-plus acres. He is credited with drawing more than 100 maps,[8] including a map of the city of Alexandria. He was involved with L'Enfant in planning the technical layout for the future capital city that would bear his name.

Washington, Innovator and Builder

In the true spirit of engineering, George Washington demonstrated his ability to create things to solve problems. Many of his innovations were designed to expand his business and to make farming more efficient and his residence more comfortable and stately. He engineered farm tools and wheat-processing facilities and designed and expanded his country estate. He was also involved in a land reclamation and canal project in the Dismal Swamp of southeastern Virginia and northeastern North Carolina.

Plow Invention

Washington's engineering achievements were numerous and varied in scale. By 1770, he had designed a new plow,[9] which was actually a combination plow and seeder. Seeds were placed in a perforated cylinder, and as the plow was moved, the cylinder rotated releasing the seeds. After experiencing some clogging, Washington redesigned the cylinder incorporating funnel-shaped holes that made it less likely for the seeds to jam.[10] He had demonstrated the tried and true engineer technique of trial and error to solve a practical problem.

Mount Vernon was largely designed and built by Washington without the assistance of an architect.

Mount Vernon Expansion

Washington greatly expanded the simple Mount Vernon farmhouse he inherited. Beginning in 1758, he turned the 1 1/2-story structure with several rooms into a 2 1/2-story, twenty-room mansion without the aid of an architect.[11] He also designed and built all twelve outbuildings placed around the central structure. Attempting to turn his property into an estate worthy of a country gentleman, Washington added a stunning two-story piazza overlooking the Potomac River and an elegant cupola on the top of his estate house.[12] With Mount Vernon, Washington demonstrated a flare for architecture.

Agricultural Facility

One of Washington's most innovative creations was his two-floor, sixteen-sided (or circular) barn. After experiencing mixed results from growing tobacco, he converted many of his fields to wheat. To separate the grain from the stalk, treading animals were commonly used. Washington wanted to create a facility that would keep the working animals out of the weather and protect his grain from theft.

In 1792, construction of his 52-foot-diameter barn began. (Remember, Washington was President at the time!) He had drawn diagrams of the structure and had done many computations to determine the bill of materials. His design specified a brick first floor and a wooden second floor. Washington's own calculations called for 30,280 bricks.[13] In the center of the barn was an octagonal room designed to store the separated grain. Horses would walk up an earthen ramp to the second floor and then tread on the harvested wheat while walking in a circle. Washington designed a space of 1 to 1 1/2 inches between floorboards to allow the separated grain to fall to the first floor. The grain was then placed in the octagonal room until it could be transported to his gristmill. The circular barn can be thought of as Washington's own threshing machine. This creation represented true originality in agricultural production.

Land Reclamation and Canal Construction

Washington spent his years between the French and Indian and Revolutionary Wars improving his estate and expanding his land holdings. In 1763, he visited the Great Dismal Swamp on the eastern border of Virginia and North Carolina, separating the Chesapeake Bay and Albemarle Sound.[14] Here he saw opportunities. Once again demonstrating his engineering vision, he suggested draining the swamp and digging a north-south waterway to connect the Chespeake and Albemarle. [15] Joining with other southern colonial businessmen, he formed two syndicates hoping to drain the swamp, harvest the trees, and use the land for farming. Washington directed the surveying and construction of a 5-mile-long ditch. By adding another trench, Washington's ditch provided a means to move logs and drain the swamp. The investors soon realized, however, that the task of draining the Great Dismal Swamp to reclaim the land was too difficult.

However, the idea of connecting the Chesapeake and the Albemarle by an inland waterway had other merit to Washington. In 1793, he and Virginia Governor Patrick Henry helped form the Dismal Swamp Canal Company to build a canal for flat-bottomed boats. The Great Dismal Swamp Canal—the oldest continually operating man-made canal in the United States—was completed by hand in 1805, six years after Washington's death.[16] In 1987, this canal was designated as a national civil engineering landmark. Today the canal is operated by the U.S. Army Corps of Engineers and provides a means for boaters to traverse between the two states, avoiding ocean exposure.

Other Contributions

The canal, estate, barn, and plow represented manifestations of Washington's engineering ability. His construction ability was initially displayed in building Fort Necessity, a stockade that he fought behind in 1754 during a losing battle with the French. In 1785, Washington became president of the Potomac Navigation Company. The company's goal was to connect a more navigable Potomac River with the Ohio River system using a portage road. Another engineer completed the road, later named the National Road.[17]

When combined with his cartographic portfolio, and considering the context of his time, there can be little doubt that Washington should be classified as an accomplished engineer. Yet, his greatest contribution to American engineering was his advocacy of developing native engineering institutions.

Washington, Master Advocate for Future Master Builders

The 19th century was a glorious time for engineering development in the United States. Engineers were often referred to as *master builders*, and chief engineers had absolute authority over all the operational, technical, logistical, financial, and administrative functions of major projects. Military engineers led many of America's largest engineering projects. These American engineers could trace their origins to 18th century George Washington.

As early as 1755, when Washington served as aide to General Braddock—English commander during the early part of the French and Indian War—he experienced the need for military engineers or pioneers firsthand. As Braddock's forces advanced from Virginia to attack Fort Duquesne (located at what is now Pittsburgh), they built a road to move the supply wagons and cannons. In front of the combined British and Virginian forces, pioneers cut a road west over the Allegheny Mountains.[18] Watching these early combat engineers, Washington must have filed away the lesson of the importance of infrastructure and the need to have the forces available to create it for military purposes.

Creating an American Corps of Engineers

Washington's later studies reinforced the importance of military engineers and sappers fulfilling important military functions, such as building field fortifications and conducting siege craft. This attitude was evident considering that after being named commander of the Continental Army on 15 June 1775, it took him *only a day* to appoint a Chief of Engineers. Colonel Richard Gridley of Massachusetts was named to that position, as he was one of the few colonials with experience in constructing fortifications.[19] Gridley's appointment was soon validated as his defensive plan provided protection for the militia in the staunch colonial effort at the Battle of Bunker Hill.

In early 1776, at Dorchester Heights, Gridley's successor, Rufus Putnam—in consultation with Washington—devised an ingenious method to erect aboveground fortifications, because of frozen earth conditions. These fortifications allowed the Continental Army to quickly emplace cannons, giving them command over the city of Boston. This positional advantage forced the British to abandon the city.

As Washington realized that the nature of the Revolutionary War would generally be defensive, he pleaded with Congress for more engineers.[20] Congress responded by recruiting foreign engineers like Frenchman Louis Duportail, who worked with Washington to establish a permanent and separate branch of sappers and miners, and Thaddeus Kosciuszko, who helped erect the formidable defenses at West Point. Washington later moved his headquarters there, as Continental soldiers continued to strengthen the Hudson River strongpoint. In 1778, Congress authorized three companies of engineers. The fledgling American Corps of Engineers enjoyed its finest hour at Yorktown in 1781 when Washington and his engineers conducted a successful siege that culminated by engineers clearing the way for the decisive assault that led to the British surrender.[21]

Advocating an American Engineering Institution

Washington's wartime experience convinced him that the new nation needed its own engineering educational institution. The long war had exposed America's dependence on European nations to provide military technical experts. On 1 May 1783, Washington wrote to Alexander Hamilton recommending the establishment of "academies, one or more for the instruction of the art military; particularly those branches of it which respect engineering and artillery, which are highly essential, and the knowledge of which is most difficult to obtain."[22]

A statue of George Washington at West Point, the first engineering school in the United States

Congress disestablished the Continental Army after the war because of strong political views against a standing military. Washington, however, continued to advocate the need for an institution dedicated to engineering instruction in the United States. In an address to Congress in 1796, making his case, he stated,

"Whatever argument may be drawn from the particular examples, superficially viewed, a thorough examination of the subject will evince that the Art of War is at once comprehensive and complicated; that it demands much previous study; and that the possession of it, in its most improved and perfect state, is always of great moment to the security of a nation. This, therefore, ought to be a serious care of every government: and for this purpose, an Academy, where a regular course of instruction is given, is an obvious expedient, which different nations have successfully employed."[23]

Washington did not live to see his academy established. He died in December 1799. In 1802, Thomas Jefferson signed legislation authorizing the establishment of a United States Military Academy. To overcome resistance to creating a purely military school, the federal law that established West Point called for an institution that produced trained officers who also possessed badly needed engineering skills for the nation.[24] West Point was the only engineering school of higher learning in the United States for fifty years. During that time, its graduates were largely responsible for the nation's initial railway lines, bridges, harbors, and roads.[25] If he had lived to see his vision materialize, George Washington would certainly have been content.

Conclusion

Washington's strong institutional support strengthens his impressive personal engineering achievements. This "Son of Martha" proved himself as an impressive practitioner and leader. Lacking formal instruction, Washington was a quick study who learned by doing. He was not afraid to apply his technical talents to solving practical farming, construction, infrastructure, or military engineering problems. Washington recognized the need for engineers in the United States Army and throughout American society. His early engineer advocacy, combined with his impressive personal portfolio, makes him one of America's great early engineers.

Author's Note: I would like to thank Professor William Calhoun of the Naval War College for his assistance in discovering the real George Washington. Attending his class on George Washington motivated me to write this article.

Endnotes

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ENGINEER UPDATE

Commercial numbers are (573) 563-xxxx and Defense System Network (DSN) numbers are 676-xxxx unless otherwise noted.

Directorate of Training (DOT)

Officer Education System (OES) Transformation. The Army is moving forward with its plans for transformation of the OES. The proposed transformation is based on findings and recommendations from the Army Training and Leader Development Panel officer study published in May 2001. The transformed education system will include the following:

- *Basic Officer Leader Course (BOLC).* This course will ensure a tough, standardized, small-unit leadership experience that flows progressively from precommissioning (BOLC I) to the initial-entry field leadership experience (BOLC II), and then to branch technical/tactical training in BOLC III. BOLC III will be held in residence at the U.S. Army Engineer School, Fort Leonard Wood, Missouri. Plans are for the BOLC to be fully implemented in the 3d quarter, FY06.
- *Combined-Arms Staff Course (CASC)* and *Combined-Arms Battle Command Course (CABCC).* CASC is designed to train staff officer skills. The Engineer School has developed a modular concept for CASC that is built around six engineer staff/technical courses: assistant brigade engineer, assistant division/corps engineer, task force engineer, geospatial manager, construction engineer, and U.S. Army Corps of Engineers engineer. All six courses will include advanced distributive learning (ADL) and new high-impact resident training experiences. These courses will provide assignment-oriented training, just in time for the staff duty position. The construct of this design allows engineer officers to receive training before assuming a staff/technical position anywhere along their career path. The six courses have some foundational knowledge in common. This commonality allows for reduced training time as officers receive the foundational knowledge in the first course attended. Subsequent courses will not repeat this baseline, but will build on it to train the unique skills and knowledge for that course.

  Like CASC, the Engineer School has developed a modular construct to train battle command skills in CABCC. The curriculum in the proposed command course is divided into seven modules: take command, train, administer, maintain, deploy, fight, and lead. Each module will include both distance learning and experiential training activities. The course will culminate with a two-week combat training center (CTC) experience.

  Currently, the Army is considering two courses of action for CASC and CABCC. The first option separates the two training experiences into two distinct courses. CASC would require the student to complete two weeks of common-core ADL, one week of branch-specific ADL, and a two-week residential phase. CABCC would require two weeks of common-core ADL, two weeks of branch-specific ADL, a four-week residential phase, and a two-week CTC experience.

  The second course of action would combine the two experiences into one course. Under this option, the student would complete three weeks of common-core ADL, three weeks of branch-specific ADL, a six-week residential phase, and a two-week CTC experience. Both courses of action will be piloted in FY05. Plans are for the selected option to be fully implemented in FY06.
- *Intermediate Level Education (ILE).* ILE will provide all majors with the same common core of operational instruction and additional tailored education opportunities tied to the officer's specific career field/branch/functional area. Plans are for ILE to be fully implemented by 4th quarter, FY05.

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Contingency Operations (CONOPS) Training. In response to the Combined Arms Center's requirement that proponent schools provide additional training opportunities to students en route to "troop-listed" units, the Department of Instruction is teaching the following subjects to identified engineer noncommissioned officers (NCOs), lieutenants, and captains:

- Mine awareness training—Iraqi-theater specific
- Iraqi intelligence briefing
- Terrain analysis—developing and manipulating data and terrain products for the country
- Combined-Arms Lessons Learned from Desert Storm and other relevant operations

This training is being given to students with assignments to U.S. Army Europe; Fort Benning, Georgia; Fort Campbell, Kentucky; Fort Stewart, Georgia; Fort Riley, Kansas; Fort Carson, Colorado; and Fort Hood, Texas. Initial sessions were held on 25 January and 1 February. This training provides a tremendous opportunity for NCOs, lieutenants, and captains who will serve together in the not-too-distant future to interact with each other here at the Engineer School.

POC is CPT Ken Boggs, Tactics Division Chief, 34132; DSN -4132; e-mail *boggsk@wood.army.mil,* or LTC Jeff Bedey, Director, Department of Instruction, 34132, DSN -4132; e-mail *bedeyj@wood.army.mil.*

Countermine/Counter Booby Trap Center (CMCBTC). The Center has developed seven countermine-related training packages: mine awareness training, mine awareness instructor training, engineer-specific countermine training, engineer-specific countermine instructor training, counter booby trap familiarization, Matilda robot training support plan

(operator maintenance and employment), and Handheld Standoff Mine-Detection System (HSTAMIDS) training support plan. By the end of February 2003, the Center will have provided training to about 4,500 troops, CONUS and OCONUS. In addition, the Center has completed or initiated the following:

- Developed handbooks to counter the mine and explosive hazards facing our forces in Afghanistan (Explosive Hazards Reference Guide) and Iraq (Commander's Guide and Soldier's Handbook). Handbooks were coauthored by the National Ground Intel Center and Navy Explosive Ordnance Disposal Technical Center. They include common mine and unexploded ordnance (UXO) disposal hazards, plus their doctrinal usage; recognition features; immediate action drills; reporting; countermeasure equipment; and tactics, techniques, and procedures to deal with these threats. The Afghanistan book addressed known land mine hazards. The Iraq handbooks consist of a common soldier handbook and a more detailed commander's reference guide. Both Iraq books include land mines and UXO hazards and are available on the Web site discussed below.
- Is developing the Tactical Minefield Database (TMFDB) in concert with the Topographic Engineering Center and its materiel developer, Northrop-Grumman/TASC. The TMFDB can track and display point, linear, and area obstacles, minefields, and explosive hazards. Built as a subset of the Maneuver Control System (MCS)-Engineer, the application is being designed to interface with the command and control personal computer (C2PC) and MCS-Light, plus input and output minefield databases to multiple formats (for example, United Nations standard Information Management System for Mine Action [IMSMA]). This capability will be exportable and available to designated units via the Secure Internet Protocol Network (SIPRNET).
- Established classified Web sites on the SIPRNET (*http://www.faisa.army.smil.mil/remote/tradocmo/*) and on the Joint Worldwide Intelligence Communications System (JWICS) (*http://www.faisa.ic.gov/remote/tradoc/tradocmo/*). It also has an unclassified Web site (*http://www.wood.army.mil/cmcbtc/*).

POC is Mr. Dorian D'Aria, 35361; DSN -5361; e-mail *dariad@wood.army.mil*.

Mine-Detection Dog (MDD) Detachment. The MDD Detachment was approved by the Vice Chief of Staff of the Army and will be established at Fort Leonard Wood in FY04. DA approved $4.8M and will fund in increments, with the first increment expected to arrive by February 2003. An additional skill identifier has been designated (K9), and eight soldiers have been assigned to the MDD Detachment.

POC is Mr. Jim Pettit, 37887; DSN -7887, e-mail *pettitja@wood.army.mil*.

WANTED! Applicants for Terrain Analysis Technician Warrant Officer. Military occupational specialty 81T NCOs with five to twelve years of service may apply. The duty description is in DA Pamphlet 611-21, *Military Occupational Classification and Structure*. Soldiers may obtain information on how to become a warrant officer on the home page of the Warrant Officer Career Center, *http://leav-www.army.mil/wocc/* or U.S. Army Recruiting Command *http://www.usarec.army.mil/hq/warrant/*.

POC is SGM James Biggerman, 37232; DSN -7232; e-mail *biggermanj@wood.army.mil*.

Proponent Guidance "Promotion Book." The Engineer Personnel Proponency Office (EPPO) prepares proponent guidance for panel members to use to select soldiers for promotion to senior grades (E-7 through E-9). The guidance is posted on the EPPO Web site for NCOs to check where they stand. New guidance is posted on the day the annual board meets. Guidance for the upcoming calendar year 03 Master Sergeant Centralized Selection Board has been completed and is posted on the Web site.

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Center for Engineer Lessons Learned (CELL). The Web site repository of lessons learned is continually being updated. We have added a listing and short synopsis of Operation Enduring Freedom lessons learned. This list will continue to be updated as we receive material. You can obtain this material by viewing the CELL Web site (*http://www.wood.army.mil/CELL/index.htm*), selecting the items you want, and sending an e-mail request or calling the CELL POC below. Most current operations material is for official use only (FOUO) and cannot be placed on a public Web site but can be sent to a *.mil* e-mail address.

We thank units and individuals that have sent digital copies of their lessons learned and after-action reports (AARs) We request that all units forward engineer lessons learned and AARs from exercises and operations to the CELL POC. This material is used to revise/develop doctrine and training and is provided to units preparing to conduct similar missions. Others can benefit from your experiences.

POC is Mr. Reggie Snodgrass, 34117; DSN - 4117; e-mail *snodgrar@wood.army.mil*.

Field Manual Update. The Doctrine Development Division will release two publications for review in February 2003. The Regiment's capstone manual, FM 3-34, *Engineer Operations*, will be released as a coordinating draft. FM 3-34.221, *Engineer Operations - Stryker Brigade Combat Team*, will be released as a final draft. The development of quality doctrinal manuals requires the incorporation of lessons learned and insights based on the operational experience of the Regiment. As part of your busy schedules, please allocate some time to review these important manuals and provide us your feedback.

POC is LTC Anthony Funkhouser, 37537; DSN -7537; e-mail *funkhousera@wood.army.mil*.

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Soldiers from the 60th Engineer Battalion, 35th Division Engineers of the 9th Army, assist German civilians in the town of Sterkrade in filling in a road crater made by one of our shells. 30 March 1945
(Photo courtesy of the U.S. Army Engineer School History Office.)

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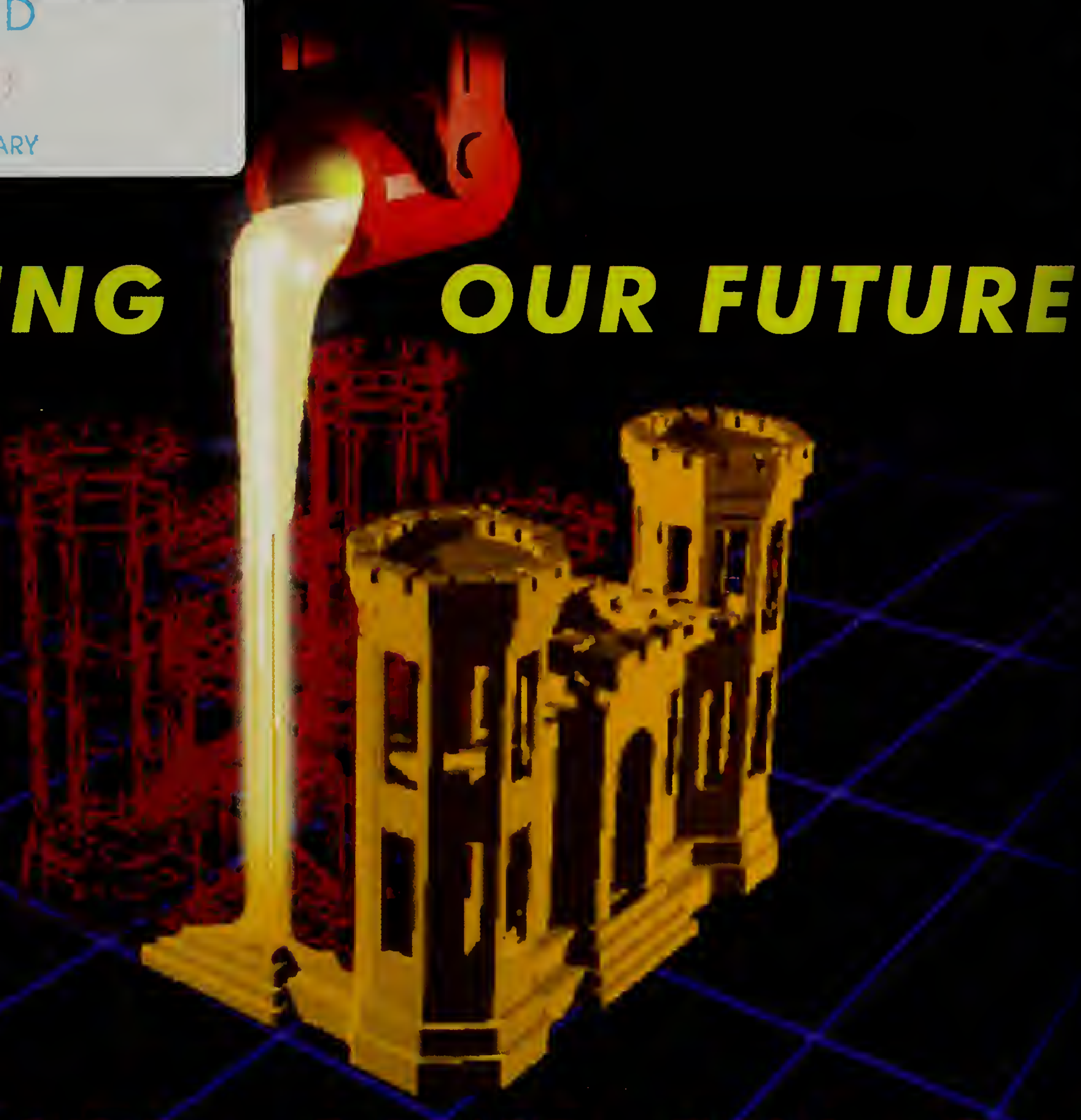

REGIMENTAL TRANSFORMATION

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Headquarters, Department of the Army
PB 5-03-2 Approved for public release, distribution is unlimited.

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Engineer (ISSN 0046-19890) is prepared quarterly by the U.S. Army Maneuver Support Center, 320 MANSCEN Loop, Suite 210, Fort Leonard Wood, MO 65473-8929. Second Class postage is paid at Fort Leonard Wood, MO, and additional mailing offices.

POSTMASTER: Send address changes to U.S. Army Maneuver Support Center, ATTN: ATZT-DT-DS-B *(Engineer)*, 320 MANSCEN Loop, Suite 210, Fort Leonard Wood, MO 65473-8929.

CORRESPONDENCE, letters to the editor, manuscripts, photographs, official unit requests to receive copies, and unit address changes should be sent to *Engineer* at the preceding address. Telephone: (573) 563-4104, DSN 676-4104. *Engineer's* e-mail address is: *bridgess@wood.army.mil*. Our Internet home page is located at: *http://www.wood.army.mil/engrmag/emag_hp.htm*.

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ENFORCE 03

CANCELED

By Captain Mark A. Winkler

In light of current world events, MG Van Antwerp, in consultation with the Chief of Engineers, decided to cancel ENFORCE 03. The Engineer School is focusing, instead, on providing the very best support possible to the Army in the field, the Regiment, and the soldiers training here during this period of increased worldwide tension. It was definitely not an easy decision because of the critical nature of ENFORCE to the Regiment's leadership and future. However, this will allow increased focus on near-term missions and requirements that will set the stage for ENFORCE 04.

Although ENFORCE 03 was cancelled, the focus on transformation is too important not to be covered in *Engineer*, our professional bulletin. The articles in this issue focus on the areas that were planned for breakout sessions at ENFORCE 03—the Objective Force, the Officer Education System, Regimental Transformation – How to Fight, Operationalizing Assured Mobility, the Countermine Center, FM 3-34, Geospatial Engineering, Terrain Visualization, and Environmental Ethics.

The Commandant will look for an opportunity later this year to host a two-day Regimental Warfighter Conference that will focus on the Objective Engineer Force, Officer Education System transformation, and lessons learned from current operations.

ENFORCE Background

The ENFORCE Conference, hosted by the U.S. Army Engineer School, is an opportunity for senior engineer leaders to come back to the home of the Regiment once a year to attend professional development seminars, receive Army institutional updates, and participate in informational exchanges—and then take this information back to the sappers on the ground.

ENFORCE, as we know it, began as the Engineer Commanders' Conference (ECC) before the school's move from Fort Belvoir, Virginia, in 1989. Soon after the move here to Fort Leonard Wood, the name of the conference changed to the Senior Engineer Leader's Training Conference (SELTC), to signify the change in focus from only engineer commanders to all senior engineer leaders. In 1995, the name changed again to the Engineer Force Conference (ENFORCE), to signify the Regiment's move into the future and its focus on what that future would hold for engineers.

Typical ENFORCE attendees are commanders and command sergeants major at the battalion, brigade, and group levels of Active and Reserve Component engineer units; senior engineer advisors to the Reserve Component units and the Readiness Groups; engineers from Corps/Major Commands; senior engineers from the Engineer School, 310th Theater Army Area Command, 98th Division (Training), U.S. Army Corps of Engineers, and Directorates of Public Works; members of the Army Engineer Association; and selected senior staff engineers.

Captain Winkler is an operations officer in Headquarters, U.S. Army Engineer School, Fort Leonard Wood, Missouri.

ENGINEER

The Professional Bulletin of Army Engineers

April-June 2003 Headquarters, Department of the Army *Volume 33 PB 5-03-2*

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CLEAR THE WAY

By Major General R.L. Van Antwerp
Commandant, U.S. Army Engineer School

In October, we here at the Engineer School began active support for Operation Iraqi Freedom. It wasn't called that then, but our involvement was an important factor in the decision to cancel ENFORCE 03. It wasn't an easy decision, and we held off on until the last possible moment. We think it was the right thing to do in many ways, but the work that was to be accomplished was to have important impacts on the future of our Regiment. That work must continue, so this issue of the bulletin remains devoted to opening the discussion on critical transformational ideas. In it we lay out some of the key conceptual, informational, and material ideas that form the basis of our overall theme: *Regimental Transformation – Forging Our Future*.

In the last two issues, I began to describe to you some of the underlying ideas behind the transformation of our Regiment. Those were some of the ideas behind assured mobility and some of the impacts of information superiority. In the following pages, more ideas—such as operationalizing assured mobility, a description of many aspects of how we will fight in the Objective Engineer Force, and ideas in the areas of the Officer Education System transformation—are explored. Each of these in turn was to form the basis for breakout sessions where you, the regimental leadership, would come together to discuss, debate, hopefully engage, and explore. That is part of what I am talking about when I say that people are our strength. People and leadership—woven together—are what will carry the Regiment into the future.

We were looking forward to the discussions at ENFORCE 03, the feedback you would provide, and the ideas you would carry away, which are vital in that effort to reach the future. These things are important, because I believe we are at the crux on transformation. We have been talking it, briefing it, writing about it, and—perhaps most painful—resourcing and funding it for more than three years.

There has been progress in a variety of areas within the overall goals of transformation, but much of that progress is not apparent, not even to those who work it every day. I assess that we, the Army, are very close to what the Chief of Staff calls sustainable momentum. I take that to mean that we are close to having a coherent concept—tied to achievable resourcing and solid science and technology—that will allow us to achieve the goal of fielding the Objective Force.

That's a remarkable thing to say, and it has some specific impacts that you, the leadership, need to understand. For example, in some ways this affects the Legacy Force. Although I think everyone will agree that every engineer leader remains deeply committed to taking care of the legacy portion of our Regiment, everyone must understand that the new force is coming, and the process of reaching that force has deep impacts on the Legacy Force. Further, it has come to the point where we must commit to the Objective Engineer Force. It is our path to ensuring that we can support the Objective Force in the future operational environment. Without the Objective Engineer Force, we will simply watch our portion of the Legacy Force fade and will see the risk inherent in future operations rise to truly unacceptable levels.

Now you notice that I have used the term leadership in several contexts within this article. In that usage comes my challenge to you. If this discussion seems difficult to understand—new ideas, new terminology, complex approaches, difficult decisions—then you are right, but your effort to understand them is an example of one of the aspects of transformed leadership that we must incorporate: lifelong dedication to learning. It simply isn't enough to say "I have mastered that skill." That's no more appropriate than an ophthalmologist saying "I am competent on the concept of contact lenses" and then never going on to grasp the idea of laser surgery. Such an inability to keep on learning simply dooms that type of leader to obsolescence in the march of new ideas. We aren't, can't be, and won't be that kind of leader. That's my first challenge to you—lifelong learning.

My second challenge to you is the other half of the leadership team—the led. I think that while many great ideas about leader development come and go, there is one enduring aspect for transformation. We must develop agile and adaptive leaders. Agile (fast on their feet, fast in their thoughts, fast in their analytical and assessment skills and make it happen, get it done, do it right) and adaptive (come out on top, work together to overcome, ensure teamwork, learn and grow) leaders can and will overcome the challenges that we and the future environment are building for them. I know that many of you have given quite a bit of attention to these types of thoughts, and I look forward to your feedback.

I know, just from the type of leaders you are, that we will get it. And even more importantly, you can count on us to use that feedback as we continue to work toward the Objective Engineer Force and toward ENFORCE 04.

Essayons!

LEAD THE WAY

By Command Sergeant Major William D. McDaniel, Jr.
U.S. Army Engineer School

I would like to use this article to reach out to all of you and highlight my travels around the Regiment. Since my message to you in the last issue of the bulletin, I attended the Sergeant Major of the Army (SMA) Nominative Command Sergeant Major (CSM) Conference in January at the U.S. Army Sergeants Major Academy at Fort Bliss, Texas. We had a week with the senior Army leaders, to include the Secretary of the Army, Chief of Staff of the Army, Army G1, Army G3, Director of the Army National Guard, Chief of the Army Reserve, TRADOC Commander, and past SMAs. Many others provided briefings and insight into our future. This was a very informative week for all attendees.

I also briefed TRADOC Commander General Brynes, the SMA, and all the Nominative CSMs on our Engineer Branch Key Initiatives. CSM Balch and myself visited and had dinner with our future sergeants major (SGMs) and their spouses who were attending the SGM Course at the Sergeants Major Academy.

Here at Fort Leonard Wood, I visited the 1st Engineer Brigade, 5th Engineer Battalion, 35th Engineer Battalion, 169th Engineer Battalion, 544th Engineer Battalion, and 577th Engineer Battalion. The 1st Engineer Brigade is a diverse organization that does remarkable work with limited manpower. The brigade produces professional, confident, and competent leaders and soldiers through the Advanced Individual Training, One-Station Unit Training, B-6 Additional Skill Identifier, and Sapper Leader Courses. In addition, the brigade provides support to the Engineer School and Noncommissioned Officer (NCO) Academy in conducting the Officer Education System, Noncommissioned Officer Education System, and Warrant Officer Candidate School.

I had the privilege of carrying the 18th Engineer Brigade unit colors from the U.S. Army Engineer Museum at Fort Leonard Wood, Missouri, to Heidelberg, Germany, and then participated in the activation ceremony of the 18th Engineer Brigade (see article on page 37.) I was the NCO of the Year for this brigade in 1983. To participate in the activation twenty years later, as the Regimental CSM, made it a very special event. This brigade is not the same as in the old days, because it is redesignated as a Theater Army Brigade. The commander, designated as a brigadier general, is COL (P) William H. McCoy.

I spent ten days in Europe, visiting the leaders and soldiers of the 130th Engineer Brigade, 94th Engineer Battalion, 54th Engineer Battalion, 1st Armored Division Engineer Brigade, 16th Engineer Battalion, 40th Engineer Battalion, 1st Infantry Division Engineer Brigade, and 9th Engineer Battalion. Then, in Kosovo, I spent a couple of days with the 82d Engineer Battalion "Blue Babes" and watched the Super Bowl with them. The leaders and soldiers from all these organizations were heavily engaged in future operations, and the morale was high. They were confident in their abilities and were prepared for any mission.

I visited the Caterpillar® plant in Peoria, Illinois, where we had soldiers training on CAT® equipment. The leadership there was doing a superb job of supporting the Regiment's needs in a professional and expedient matter. It is a great team effort, and the support cast at CAT was doing it right in every facet of the requirements. My special thanks go out to Mr. Frank Weinburger, Mr. David Haney, Mr. Rick Sharp, and Mr. Thomas Brady.

I continually spread the word about our engineers at the U.S. Army Engineer School. They are a great team of dedicated professionals who strive to provide key information and solutions to the many issues that our leaders identify and inquire about. These important issues come in daily, and our engineers here always provide quick response to the field.

We continue to support the Regiment through a host of different means. One example of excellence is our mobile training teams (MTTs) that are providing countermine training throughout CONUS and OCONUS (Germany, Kuwait, and Afghanistan). They are doing a great job, and I have received positive feedback from leaders throughout the Regiment. As BG Castro says, we are a "Team of Teams"—always supporting and reaching out to each other.

I realize that as a Regiment we are extremely busy and engaged in a multitude of ongoing missions. I will continue to encourage you to keep safety on the forefront when performing our missions. Continue to take care of the soldiers and their families, because this is one of our most important missions, and if done right, everything else will be accomplished easily. Remember that we can only be effective if we take care of ourselves; if we don't, then we can't focus on taking care of our soldiers and the mission at hand.

I want to congratulate CSM Rodney Craddock as the new 18th Engineer Brigade CSM and CSM Gerald Jones as the new 1st Engineer Brigade CSM. I also want to thank CSM Dave (and Rosie) Delgado for their professionalism and dedication to the Regiment as they transition into retirement. They have been a superb command team and family. We bid them farewell and wish them the very best in the future.

In closing, let me say thanks for your dedicated support to our great Regiment. It is held in high esteem, and that is due largely to all our efforts. We are a Regiment that takes great pride in producing superior results. We are always on the cutting edge of full-spectrum engineering with the energy of taking care of each other, our soldiers, and their families—while giving our total support to mission accomplishment. Be proud of whom you are, and always let those around you know that you are a proud member of the best Regiment in our Army. God bless you all.

Essayons!!

Objective Force 101

By Captain Mark A. Winkler

Most of us have heard the term Objective Force. For many, this conjures up images of an Army that has done away with the very combat forces that have made us the premier military in the world. For some, it causes a sense of excitement, knowing they will be leaders in cutting-edge technology. For a few, it causes a glazed-over look of confusion and boredom. This Objective Force tutorial is written in an effort to clarify some misconceptions, introduce some new terminology, and lay a foundation of understanding concerning the intent of the Objective Force and the Army Vision. It is imperative that officers and noncommissioned officers have a basic understanding of the concepts, doctrine, and terminology so they can support the Army Vision and Transformation process.

Army Transformation

The Army regularly undergoes transformation to meet current and future national military requirements. In the emerging asymmetrical combat environment, the Army—and the Corps of Engineers—are once again rethinking our strategies, equipment, and training doctrine to meet current and future national security contingencies. The environment has changed; therefore, we must change. Our current structure is a Cold War relic not designed to support the full spectrum of operations. Engineer units are not sufficiently responsive, deployable, and agile to meet the realities of the Objective Force.

The Army Transformation Plan is based on Army Chief of Staff General Eric K. Shinseki's Vision for the Army: "Soldiers on Point for the Nation...Persuasive in Peace, Invincible in War." The vision includes three primary components starting with an overriding requirement, key principle, and primary objective statement. Readiness continues to be the Army's top priority requirement. The principle recognizes that the Army's people are the centerpiece of Army capabilities and represent the most important element of change. The objective statement sets the tone for Army Transformation. It calls on the Army to create "strategic dominance across the entire spectrum of operations" with seven broad goals. They are to make the Army more *responsive*, *deployable*, *agile*, *versatile*, *lethal*, *survivable*, and *sustainable*. These goals underscore everything.

Army leaders contend that Army Transformation is one of the most sweeping institutional changes ever designed. It involves more than new equipment, vehicles, uniforms, basing, doctrine, tactics, training, or any other single or coupled aspects. Army Transformation is a complete paradigm shift in training, doctrine, equipment, and institutional thinking. Army Transformation has three key elements: the Legacy Force, the Interim Force, and the Objective Force. These will be separate initiatives for the first decade of the 21st century but will merge during the second decade to create the final product, which is envisioned as a whole new Army.

The term *Legacy Force* centers on current major weapons systems, principally combat maneuver vehicles and armored fire support and combat support vehicles. Known as the heavy force, it comprises the Army's mechanized infantry and armored divisions. The Army will continue upgrading the heavy force while developing other paths. The Legacy Force will still be the Army's primary warfighting maneuver force for the foreseeable future.

The plan for the *Interim Force* is to use available technology to reequip brigade-sized units to adapt them to meet many of the Army's missions. This will enable them to deploy more quickly than the heavy forces but have greater lethality, speed of mobility, and soldier protection than the Army's light forces. Although Interim Force units will handle conventional missions, they will also be used to develop much of the doctrine and training aspects of the Objective Force.

The *Objective Force*, currently in the development phase, represents the vision of the future Army: what can be done to equip, organize, and train units to integrate the best aspects of the heavy, light, and interim forces. For example, the Army is conducting core research to create a new family of lighter armored fighting vehicles, called the Future Combat System, that offers equal or better protection for soldiers who will use them.

Objective Force: The Big Picture

The Objective Force Model consists of two primary echelonments: units of employment (UEs) and units of action (UAs). UEs function primarily at the operational and strategic level of war and are concerned with the prosecution of campaigns and major operations. UEs have the headquarters structure to perform as a joint task force and are highly tailorable to mission requirements. UAs function primarily at the tactical level of war and are concerned with planning and fighting engagements and battles. They are semifixed organizations, capable of training and operating across the full spectrum of operations, and are inherently combined arms.

Misconceptions

There are three major misconceptions about Army Transformation:

- *Misconception No. 1:* The plan is for the Army to divest its tanks and mechanized infantry fighting vehicles quickly in favor of lightly armored, wheeled vehicles. That is wrong. Abrams tanks and Bradley fighting vehicles will remain in the Army's inventory for decades.
- *Misconception No. 2:* Interim Brigade Combat Teams will replace light forces. That is not right either. Airborne, air assault, light infantry, and special operations forces will continue to be the Army's forced-entry team. The Initial Brigade Combat Teams are not being organized to be the tip of the spear.
- *Misconception No. 3:* The Interim Brigade Combat Teams are just peacekeeping forces. Wrong again. They will have major wartime missions in addition to being able to handle operations other than war. They are combat formations first and foremost and will have a substantial amount of firepower. There are a number of roles for them on the battlefield.

Machines That Perform; Soldiers Who Think

Objective Force equipment will have vastly increased capabilities, but soldiers will have a larger responsibility to interpret information that the systems provide. The Stryker Brigade Combat Teams at Fort Lewis, Washington, are focusing on training individual soldiers to maximize the use of the information they receive. Meanwhile, leadership training that emphasizes flexibility and adaptability starts at the lowest level and continues up the chain of command. The goal is to prepare soldiers to assume a leadership role at one or two echelons above their own and to be better prepared for those jobs when they are promoted to them. Soldiers will utilize live-virtual-constructive training venues in both classroom and field environments. Simulations and enhanced situational training exercises will develop their leadership potential and technical capabilities.

Captain Winkler is an operations officer in Headquarters, U.S. Army Engineer School, Fort Leonard Wood, Missouri.

ENGINEER OBJECTIVE FORCE CONCEPT: "HOW TO FIGHT"

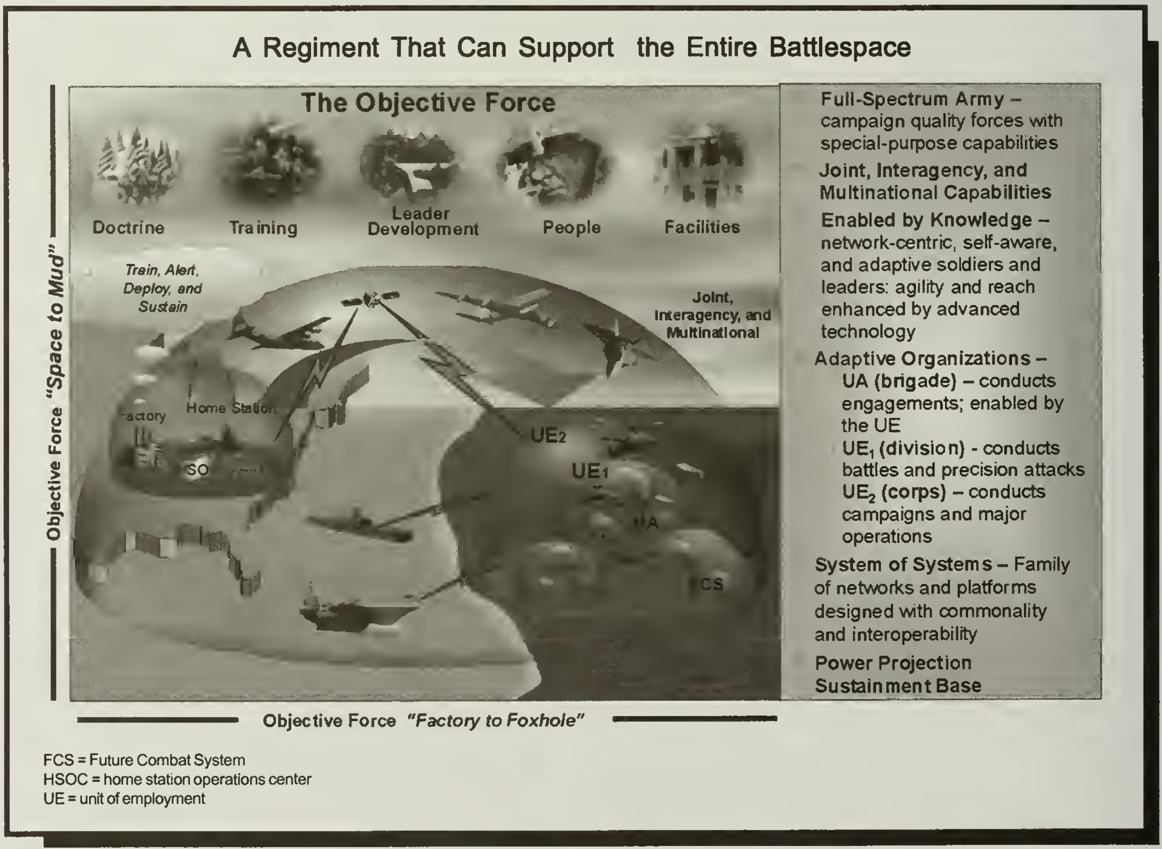
By Mr. Mike Fowler

As everyone knows, the environment of our world has changed, and the Army is transforming to adapt to this new environment. The Army's goal, referred to as the Objective Force, has led us to look at the Engineer Regiment to examine how engineers will fight in the future.

Objective Force

Before discussing the overarching Objective Force engineer concept, it is imperative that we review how the Objective Force maneuver unit of action (UA) is designed to fight. The Objective Force is a full-spectrum force, capable against an adaptive, learning enemy in all terrain conditions (see Figure 1). It operates with greater effectiveness and versatility and achieves greater empowerment in small-unit tactical operations through improvements in the—

- Development of the situation out of contact.
- Information dominance that allows unprecedented situational awareness and situational understanding.
- Ability to know and use terrain and weather to a degree that removes the enemy's "home court" advantage.
- Standoff destruction of enemy systems.
- Assured mobility that creates a significant mobility differential relative to the adversary.
- Embedded, robust, all-weather, 24/7 intelligence, surveillance, and reconnaissance.
- Ability to achieve assured lethality with a very high probability of hit—and assured kill with an equally high probability of kill given a hit—all beyond the range of the enemy's weapons.
- Ability to achieve three-dimensional mutual support between units on parallel axes while on the move.
- Ability to plan collaboratively and rehearse virtually while on the move, arriving at the objective on parallel axes.
- Precision fire control and distribution when conducting tactical engagements at the small-unit level.


A Regiment That Can Support the Entire Battlespace
The Objective Force
Doctrine
Training
Leader Development
People
Facilities
Train, Alert, Deploy, and Sustain
Joint, Interagency, and Multinational
Factory
Home Station
HSOC
UE2
UE1
UA
FCS
Objective Force "Space to Mud"
Objective Force "Factory to Foxhole"

Full-Spectrum Army – campaign quality forces with special-purpose capabilities

Joint, Interagency, and Multinational Capabilities

Enabled by Knowledge – network-centric, self-aware, and adaptive soldiers and leaders: agility and reach enhanced by advanced technology

Adaptive Organizations –
  UA (brigade) – conducts engagements; enabled by the UE
  UE_1 (division) - conducts battles and precision attacks
  UE_2 (corps) – conducts campaigns and major operations

System of Systems – Family of networks and platforms designed with commonality and interoperability

Power Projection Sustainment Base

FCS = Future Combat System
HSOC = home station operations center
UE = unit of employment

Figure 1

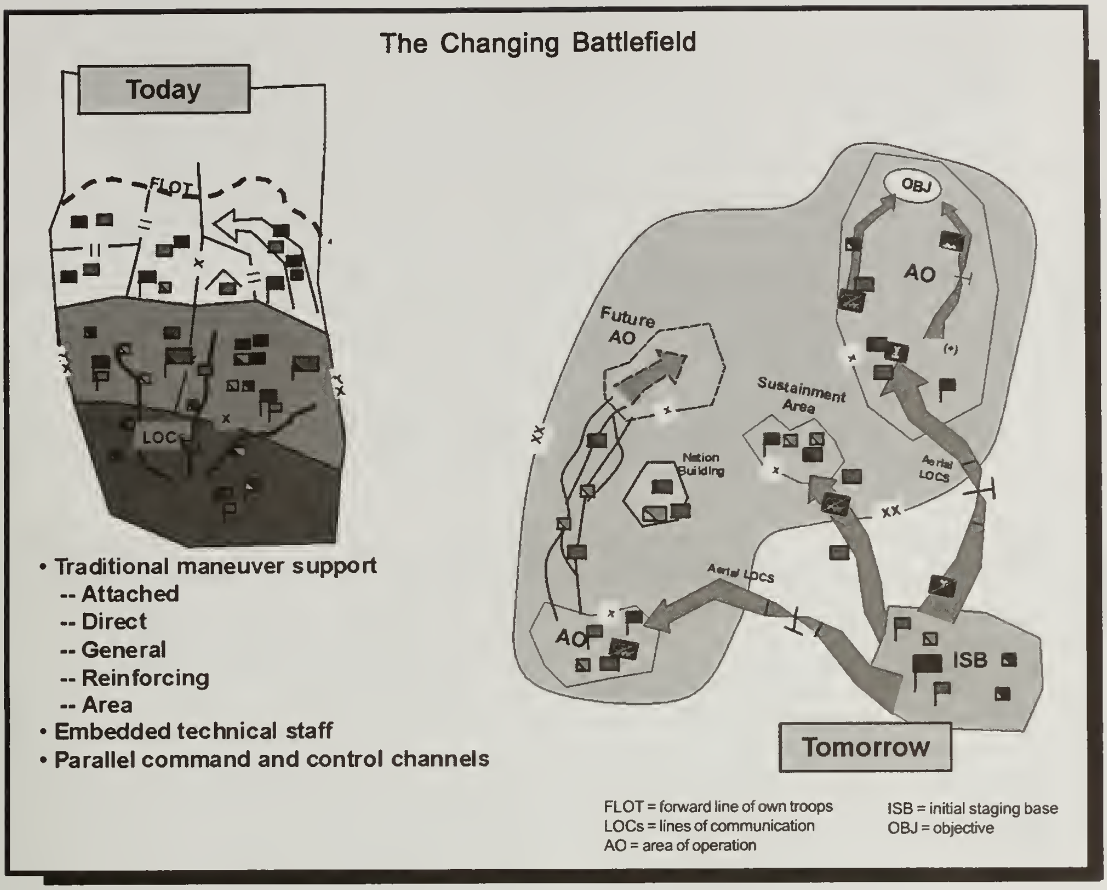


Figure 2

- Standoff detection and neutralization of mines; booby traps; improvised explosive devices; and chemical, biological, radiological, nuclear, and explosive threats.
- Inherent air-ground integration.
- Manned-unmanned teaming with organic unmanned systems.
- Reliability of combat power.
- Seamless transition while in contact.

Ultimately, decisive operations require tactical success in close combat—the capability to seize and control key terrain and to close with and destroy enemy forces. In this sense, close combat actions are the fundamental building blocks for operational success and strategic victory. The Objective Force executes decisive combat operations by denying the enemy freedom of action and destroying him through a series of rapid, violent actions. Future engagements will be characterized by new tactical principles based on the development of the situation out of contact and the balanced combination of standoff capabilities, skillful maneuver, and tactical assault to achieve simultaneous decisions at multiple locations. Continuous integration of powerful, small tactical units—moving along multiple, noncontiguous lines of operation to objective areas that are force-oriented—is the foundation underlying the success (see Figure 2).

Objective Force Engineers

One of the challenges that the Engineer Regiment must address is that under our current structure, engineer units are not responsive, deployable, agile, versatile, or sustainable in the context of the Objective Force. Some overarching concepts have been developed to help eliminate these shortfalls:

- Foundation forces and force pools
- Command and control cells
- Early-deployable detachments (EDDs)
- Construction modules

Foundation Forces and Force Pools

One of the underlying concepts in the Objective Force engineers is the design of foundation forces and force pools. Foundation forces are the building blocks for projecting engineer capabilities into tactical units. They are made up of engineer effects modules (EEMs) and engineer mission teams (EMTs) with a broad baseline capability. The foundation force relies on the force pool to provide mission-specific capabilities. The force pool is the primary force provider, comprised of a modular base structure with a fixed organization of discrete sets of capabilities. This enables rapid force tailoring and a scalable robustness to allow for maximum operational flexibility.

Both organizations have an inherent design for small-unit excellence. In both the foundation force and the force pool, organizations are based on engineer mission forces (EMFs), which are compatible with the engineer battalion of today.

Command and Control Cells

Developing a command and control structure that is projectable and scalable to support the foundation force and force pool concept will be a challenge. This concept breaks out command and control headquarters (HQ) into four cells that vary among the standing (regiment/brigade), foundation force, or force pool HQ. The command and integration cells are the bulk of the standing and foundation force HQ.

- *Command cell*—contains the command group and is responsible for issuing orders, executing current operations, providing the vision for future operations, and providing a command presence.
- *Integration cell*—provides control for current operations and battle tracking, participates in combined arms planning, and produces orders.
- *Technical cell*—provides a specific engineer expertise that analyzes the engineer's common operational picture (COP) and provides technical advice and design to help produce solution sets. This cell, which is also responsible for the reachback for technical assistance, is more robust in the force pool HQ.
- *Sustainment cell*—tracks readiness, plans and coordinates sustainment operations, and anticipates logistical requirements. Engineer regiment and brigade HQ have a larger sustainment cell.

As EMFs are task-organized, the modularity of these cells form together to provide the right HQ structure to support the mission requirements.

Early-Deployable Detachments

A new capability embedded in engineer organizations is an EDD. This capability is a small, rapidly deployed team that enables engineer solutions out of contact and allows precise employment of engineers. The EDD would be organic to organizations with an EMF role and, in some cases, may have duty in a Corps of Engineers role to enhance its professional engineer skills. Once deployed, an EDD begins to build/update the engineer COP for the specific mission, identifies problems, and initiates reach to get the expert centers to develop solutions and shape the engineer battle through identifying contracts and resources available.

Construction Modules

There are several aspects of the construction battalion concept. The first is designing modules that can be easily deployed that will allow the battalion to phase in its capabilities with the maneuver force. The construction EDD is made up of technically trained soldiers who can begin to identify and prioritize the required engineer missions that must be accomplished and begin to reconnoiter possible contract support. The next step is a skid steer-type platoon. This platoon is equipped with commercial skid steers and a variety of attachments that allow it to begin some limited work. The skid steer operators are trained on heavy construction equipment, so if more robust requirements exist, they can use commercial construction equipment. The primary role of this platoon is to support the first-deployed maneuver forces with unmanned aerial vehicle landing areas, rotary wing sights, forward area rearming and refueling points, and limited airfield repair. As deployment continues, these limited teams are followed by a light air-transportable construction company, which gives additional capability in a deployable package. The company will provide increased airfield repair and main supply route maintenance. The rest of the battalion is comprised of heavier construction equipment that is capable of supporting a sustained military operation.

There are some additional changes that must be addressed to fully embrace the Objective Force. As we look at the current level of construction equipment and the Army dollars that are available to update this fleet, we find that there is a considerable shortfall. This initiative looks at reducing the number of construction equipment items while maintaining the operators, allowing for 24-hour operations. Reduced equipment strengths would then be augmented with rental equipment for surge capability. This would also find efficiencies in deployment and maintenance. This concept will require some major changes. Standing lease/rental agreements must be developed which would require changes to the current acquisition laws. Additional analysis needs to be conducted to determine the optimized amount of equipment for current operations and training. As we rely on industry to support us abroad with equipment, our operators must be readily adaptable to the differences of equipment by manufacturer. One way to help this and to stay proficient with operator skills is to field configurable construction equipment simulators.

Conclusion

The Army is changing. The enemy is changing. The way we fight will change. Engineers in the future will have greater demands forced upon them. Developing solutions out of contact over noncontiguous operations, with a greater reliance on support to future maneuver, are just some of these demands. Engineers may not be organic at all echelons in the future, but engineer requirements will still exist. The Engineer Regiment must be a relevant option for the maneuver commander. It will take the efforts of the entire Regiment to get this change right. The Engineer School must receive your support and feedback to accomplish this challenging task.

Mr. Fowler, a military engineer development analyst, has worked in the Directorate of Combat Developments, U.S. Army Engineer School, and more recently, the U.S. Army Maneuver Support Center, at Fort Leonard Wood, Missouri, for fourteen years. During the past ten years, he has been involved in developing engineer concepts, to include those for Force XXI, the Stryker Brigade, and the Objective Force.

Stryker Brigade Combat Team: A Window to the Future

By Lieutenant Colonel Robin Selk and Major Ted Read

We are often admonished to "improve your foxhole every day, because you never know how bad you might need it tomorrow." The foxhole and the defense allow us time to prepare for an offensive operation.[1] Army Transformation calls for a similar effort, to get better every day while preparing for future operations. To that end, the Stryker Brigade Combat Team (SBCT) is an existing formation, an organization that is optimized for mobility, and a lens through which we can glimpse the future.[2]

With one organic engineer company supporting the SBCT, the mobility capability of the formation has been questioned. When we look at the strategic, operational, and tactical mobility of any organization, there are always trade-offs. A light organization has excellent strategic mobility but does not have the organic transportation assets that give it operational and tactical mobility. Likewise, the heavy forces have unmatched tactical mobility and speed in many environments at the expense of strategic mobility. The operational mobility of the heavy force is very dependent on local infrastructure and a large logistics and engineering tail. In the SBCT, the three forms of mobility are optimized for high-end, small-scale contingencies. According to the SBCT operational and organizational (O&O) concept, augmentation of the engineer company will be necessary when the brigade undertakes special operations support element or movement control office missions.[3] Looking through our lens to the future, it is clear that the situational understanding of the SBCT and future forces will be a fundamental mobility enabler. Proactive use of situational understanding through emerging doctrine will help to prioritize the use of SBCT engineer assets to provide mobility to the decisive force. In the Objective Force, we will see other units designed to exploit the information gained through situational understanding. Prudence dictates that we invest thought and resources into the SBCT's development and doctrine.

The concept and organization of the SBCT's engineer companies has changed little since the report published in the May 2001 issue of *Engineer*.[4] One can see the mobility focus in the organization of these companies as shown in Figure 1, page 10. A rough estimate of the unit's mobility capability is as follows: the three combat mobility platoons have a combined mobility capability of 400 to 900 kilometers of level 1 route clearance and 540 meters of mine-clearing line charge (MICLIC) lane reduction, plus rollers and plows. The mobility support platoon will have the capability to cross four gaps simultaneously with the rapidly emplaced bridge system. The bottom line is that by design, the organic engineer company is optimized for the mobility requirements of the SBCT.

To address the augmentation of the SBCT, the commander of the 555th Engineer Group presented a series of initiatives, known as the Engineer Augmentation Package (EAP), to the Engineer Council of Colonels in October 2002. The EAP concept provides the SBCT with a set of tailored modules to address operational and tactical missions outside of the SBCT's current capabilities (see Figure 2, page 10).

The EAP is designed to augment all of the operational requirements of the SBCT. It will provide the SBCT with greater mobility, countermobility, and survivability options in theater, to enhance the maneuver force's ability to conduct combat operations. This is done through the organization of five EAP modules:

- *Sapper module*—provides assets for route reconnaissance, local security, conventional mine emplacement, scatterable mine emplacement, obstacle reduction,

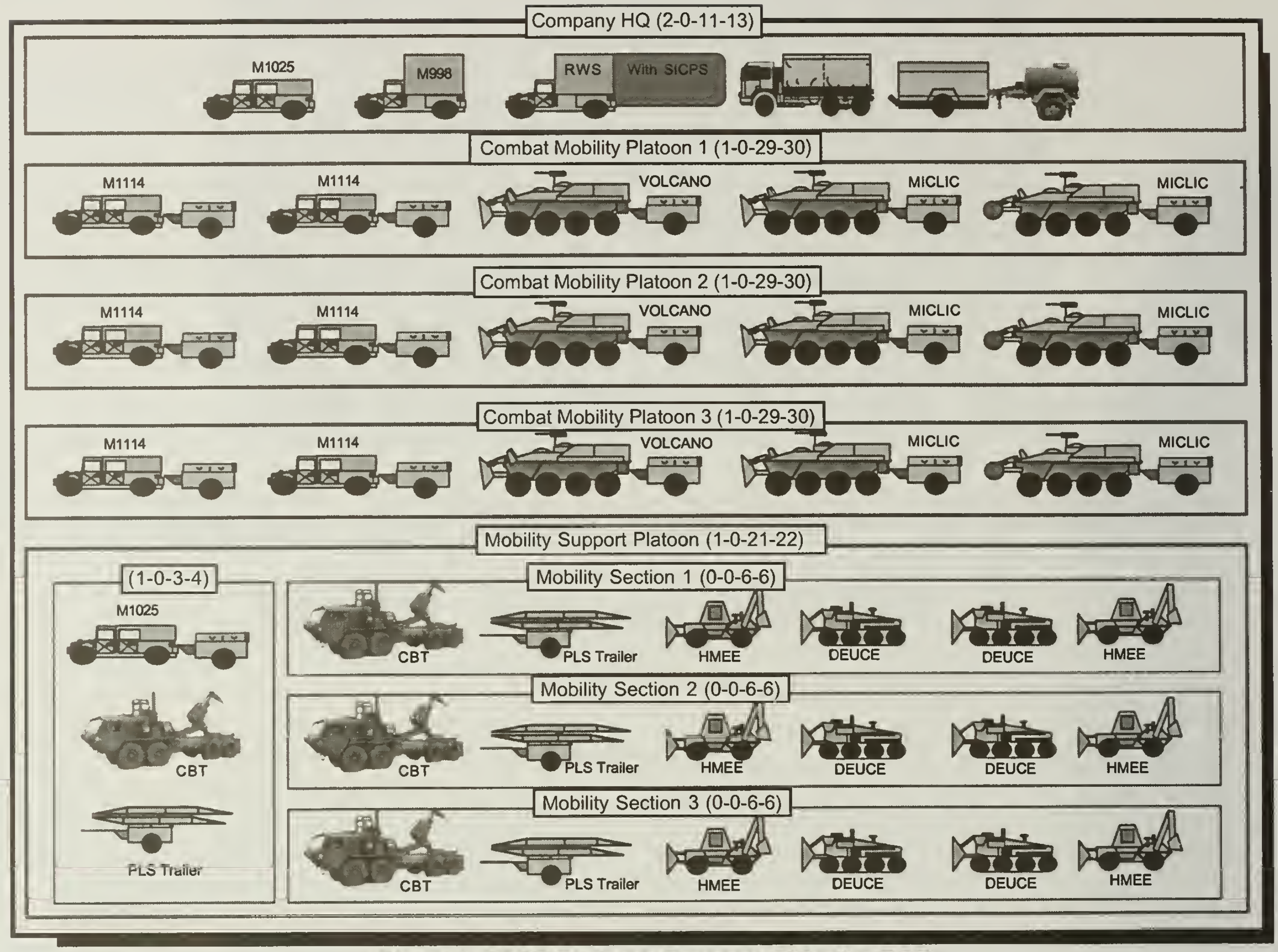
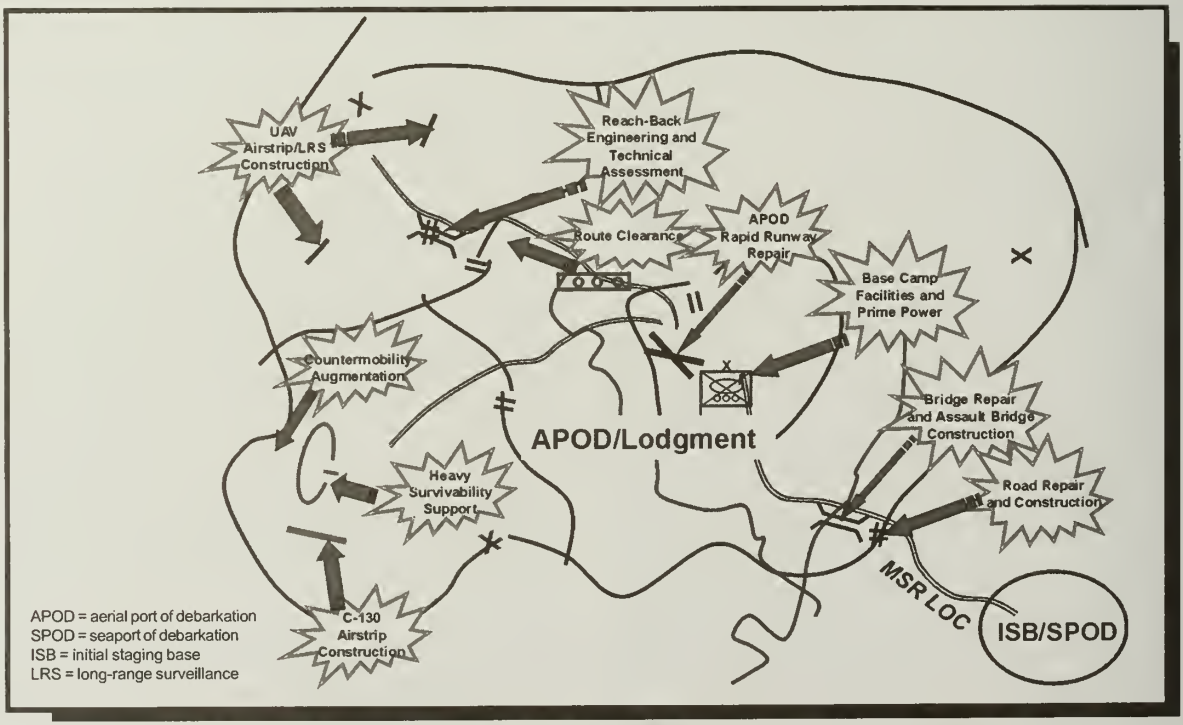


Figure 1. SBCT Engineer Company Objective TOE


UAV Airstrip/LRS Construction
Reach-Back Engineering and Technical Assessment
Route Clearance
APOD Rapid Runway Repair
Base Camp Facilities and Prime Power
Countermobility Augmentation
APOD/Lodgment
Bridge Repair and Assault Bridge Construction
Road Repair and Construction
Heavy Survivability Support
C-130 Airstrip Construction
MSR LOC
ISB/SPOD

APOD = aerial port of debarkation
SPOD = seaport of debarkation
ISB = initial staging base
LRS = long-range surveillance

Figure 2. SBCT Support Missions (Combat Engineer Task Force [Corps Wheel Company/Battalion])

route and area clearance, stability and support operations, and mine-clearing operations support.

- *Horizontal module*—provides assets for main supply route (MSR) construction from unimproved trails or combat trails to gravel roadways, unmanned aerial vehicle (UAV) airstrip construction, rapid runway repair, MSR repair, road crater repair, survivability positions, and Hesco Bastion fortifications.
- *Vertical module*—provides for temporary base camp construction, to include the tactical operations center (TOC), guard towers, living areas, a dining facility administration center, and shower and lavatory facilities.
- *Bridge module*—provides additional bridging assets to the SBCT to include the medium girder bridge, the assault float bridge, the Mabey-Johnson bridge, and crossing-area engineer support.
- *Heavy module*—further augments the horizontal module, allowing it to provide complete survivability support, high-traffic roadway construction, new roadway construction, and increased productivity in all other horizontal operations. The heavy EAP module is not C-130 mobile.

The EAP modules will be organized with a command and control design that can be tailored to meet the needs of the mission (see Figure 3).

The engineer company mission in the SBCT O&O specifies that augmentation may be required "... on order, with augmentation, provides additional mobility (lines of communication [LOCs]), countermobility, survivability, and sustainment engineering support to the Interim Brigade Combat Team ..."[5] Today's challenge is to ensure that there is robust, deliberate, and perhaps contentious dialogue to refine the augmentation and organizational packages that will ensure the survivability and sustainment of the SBCT in future operations.

The U.S. Army Engineer School has worked closely with SBCT leadership to improve the mobility of the force with organic enablers in the nonlinear, noncontiguous battlefield of a small-scale contingency. In July 2002, during the Senior Leaders Course, assured mobility was introduced to the 1st Brigade, 25th Division (SBCT #2), to give unit leaders the tools to optimize their mobility by using situational understanding as a fundamental enabler. The instruction at the Senior Leaders Course, and the following Tactical Leaders Course in September 2002, was well received by the 1st Brigade commander and his subordinate commanders. The confidence they had in the concept was such that the brigade requested that the agenda of a second Tactical Leader Course, scheduled in November 2002, be modified to include discussion of assured mobility.

The central theme of the training was to help the SBCT leadership realize and use their unique enablers to answer the following commander's focus question: What must I do to sustain my ability to maneuver, to prevent enemy interference, and to protect the force in order to accomplish my mission?

The assured mobility framework seems most successful in providing an answer in the proactive, enabling perspective of warfare. The SBCT leadership addressed the six assured mobility fundamentals—predict, detect, prevent, avoid, neutralize, and protect—through an analysis of the four imperatives: develop the mobility common operational picture (COP), establish and maintain operating areas, attack the enemy's ability to influence, and maintain mobility and momentum. Analysis should be conducted from both friendly and enemy points of view, using three perspectives: en route to, on, and beyond the objective. The use of these perspectives is critical to success. The end result of the training was leaders looking at the battlefield from a new, proactive perspective

(Continued on page 14)

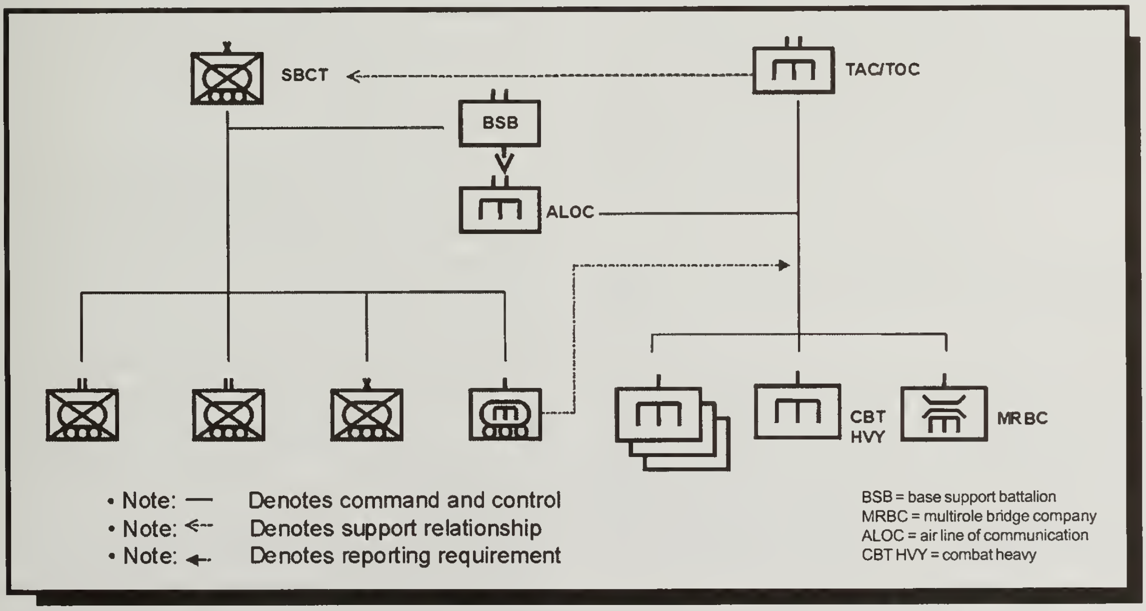

SBCT
TAC/TOC
BSB
ALOC
CBT HVY
MRBC
• Note: — Denotes command and control
• Note: <-- Denotes support relationship
• Note: ◄- Denotes reporting requirement
BSB = base support battalion
MRBC = multirole bridge company
ALOC = air line of communication
CBT HVY = combat heavy

Figure 3. EAP and SBCT Support/Command and Control Relationship

PROVIDING ASSURED MOBILITY IN THE UNIT OF ACTION

By Major Ted Read and Major Nelson "Glenn" Kerley, Jr.

"Convinced that the general advance in the weaponry of the world's armies was introducing a tactical revolution in land combat which rendered the organization of the ROAD [Reorganization Objective Army Divisions] ...obsolete, the TRADOC commander, General DePuy, set in train in 1976 a restructuring study of the heavy division."[1] General DePuy was concerned that the Army would miss the opportunity to build organizations around the newest technology of the time. From this beginning, the Army of Excellence and its doctrine, AirLand Battle, were born.

Concept

The concept is not much different today. The Army is working hard to define success in the future battlefield with the technology and doctrine of the future. The Army is reaching for flatter organizations and processes with enduring doctrine, as U.S. Army Training and Doctrine Command (TRADOC) Pamphlet 525-5, *Military Operations Force XXI Operations*,[2] described almost ten years ago. The Engineer Regiment has contributed heavily to the description of the future battlefield and its systems and doctrine by providing assured mobility within the maneuver support battlefield function.

Providing assured mobility is a critical imperative of the maneuver support battlefield functional area for Objective Force operations. Maneuver support is thoroughly discussed in *The United States Army Objective Force Maneuver Support Operational Concept, Coordinating Draft*,[3] and incorporated in TRADOC Pamphlet 525-3-90, *The United States Army Objective Force Operational and Organizational Plan Unit of Action*.[4] It concentrates on two interrelated components: freedom of maneuver and force protection. The figure on page 13 displays the seven maneuver support imperatives, although the dependencies are more complicated than the simple model depicts.

Evolving an assured mobility framework to meet the needs of the Objective Force begins with the definition: "Actions that guarantee the force commander the ability to deploy, move, and maneuver where and when he desires, without interruption or delay, to achieve his intent. This includes maneuver in all types of terrain and weather, including urban terrain."[5]

Assured mobility will create a mobility differential relative to the adversary, significantly contributing to the unit of actions's (UA's) greater empowerment in small-unit tactical operations.[6] When applied near the objective, the UA forces will avoid enemy kill zones, increasing their ability to close with and destroy the enemy.[7]

The most notable automation/technology change is our ability to move from focusing on the mobility perspective of the common operational picture (COP) as an imperative to a more holistic approach in developing the situation. The key is still a proactive-centric method that establishes predict-to-prevent linkages that will allow commanders to leverage analysis and collection capabilities, predict enemy actions to hinder his mobility, and then take proactive measures to prevent the enemy from impeding our maneuver. A commander may make or alter his maneuver plan to avoid known impediments. If required, he will neutralize, reduce, or overcome the impediments to his mobility that cannot be prevented or avoided. Through a structure of systems and improved processes, we will provide assured mobility to the future commander.

The imperatives—as defined in the article on page 15, "Operationalizing Assured Mobility"—change in scope and become four nested and overlapping tasks that require providing assured mobility: develop the situation; select, establish, and maintain operating areas; attack the enemy's ability to influence operating areas; and maintain mobility and momentum from standoff to greatly reduce the likelihood of traditional breaching or neutralization.

Develop the Situation

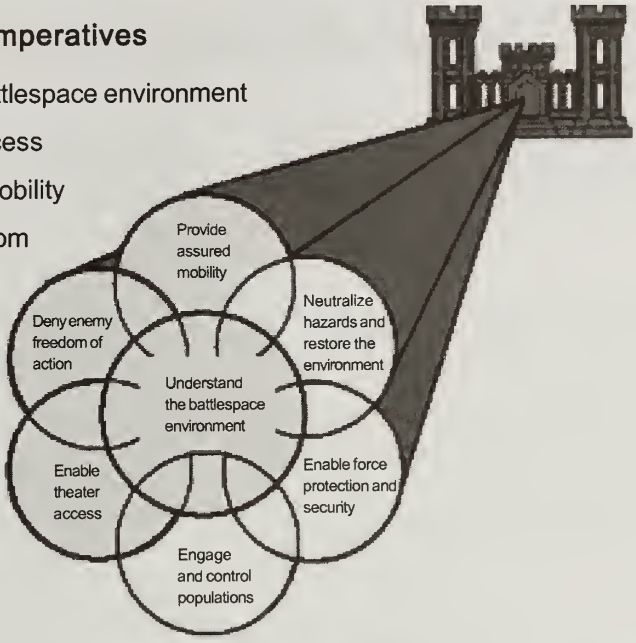
"This is the collection and integration of imagery and geospatial, cultural, and enemy information—aided by automated mobility planning tools—to establish the mobility COP for the operating area."[8] Automated terrain products and dissemination will allow commanders at all levels to understand the total implications of the terrain and how to leverage it to a tactical advantage. Potential capabilities include a tool that quickly produces a modified combined-obstacle overlay and publishes mobility courses of action. The overlay would be dynamically updated as refinement and alterations of the terrain are reported.

Select, Establish, and Maintain Operating Areas

"With the aid of automated tools, critical mobility choke points, operating areas, and airspace are identified, and a

Engineer-Focus Imperatives

- Understand the battlespace environment
- Enable theater access
- Provide assured mobility
- Deny enemy freedom of action


Provide assured mobility
Neutralize hazards and restore the environment
Deny enemy freedom of action
Understand the battlespace environment
Enable force protection and security
Enable theater access
Engage and control populations

shaping plan is developed en route to the area of operation (AO). Operating areas are designated portions within the AOs that the maneuver commander has identified as relevant to the scheme of the maneuver. This plan includes prediction of enemy actions and required sensor coverage to fill any information voids within the operating area. Through this proactive process, sensors 'stare' at critical areas to fill the voids or improve our situational awareness. In coordination with sensor-effects packages, the ability to predict, detect, prevent, avoid, and neutralize the enemy's ability to emplace or use mines and booby traps from stand-off positions sets the conditions for mobility situational understanding. For critical choke points such as bridges, sensor packages linked with brilliant munitions form an active protective system to eliminate the enemy's attempt to influence or degrade these critical points. The ability to control and monitor critical mobility areas are essential to coordinating a mobility plan in conjunction with the scheme of maneuver."[9]

Attack the Enemy's Ability to Influence Operating Areas

"This task includes the specific actions to be taken to preclude, deny, or prevent enemy maneuver and facilitate the UA's movement. The commander proactively attacks those enemy systems capable of directly or indirectly impeding friendly maneuver, thus destroying route interdiction capability before it occurs. This includes precision fires and munitions, obstacles, and attack by aircraft. Precision munitions (all types) and dynamic obstacles (Intelligent Munitions Systems [IMS]) are effective and important methods of hindering the enemy's freedom of movement. Sensor suites tied to point munitions and networked fires are also employed to protect freedom of maneuver once it is established in key operating areas or along key routes."[10]

The operational employment and utility of the IMS is discussed in the *IMS Operational Employment Concept*[11] and the *UA O&O Plan*.[12] The IMS operational requirements are outlined in the *Future Combat System (FCS) Operational Requirements Document*,[13] and the IMS is being developed within the FCS. More information on the IMS is provided at the TRADOC System Manager–Engineer Combat Systems Web site at *http://www.wood.army.mil/TSM/*.

Maintain Mobility and Momentum

"Most mobility impediments will be mitigated through prediction, detection, and prevention. Obviously, if operationally feasible, impediments to maneuver will simply be avoided. There will be situations in which operational requirements dictate negotiation of impeded routes. Based on FCS survivability to antipersonnel mines and some chemical, biological, radiological, and nuclear (CBRN) hazards, the commander may choose to simply detect and move through the area."[14]

Summary

As a doctrinal framework, assured mobility truly achieves General Sullivan's vision of "a doctrine today and tomorrow"[15] that he had while the Army's leadership was laying the post-Cold War foundations for doctrine we are using today. The proof of the product is that doctrine as written in FM 3-34, *Engineer Operations*, (see article on page 20) has been accepted throughout the Army as a standard for constructing operational thought. And as an imperative to the future maneuver support battlefield functional area, it has been accepted as hard requirements for tomorrow's Objective Force.

Endnotes

[1] Romjue, John L. (1997) *The Army of Excellence: The Development of the 1980s Army,* Washington, D.C.: Center of Military History, p. 8.

[2] TRADOC Pamphlet 525-5, *Military Operations Force XXI Operations,* August 1994.

[3] *The United States Army Objective Force Maneuver Support Operational Concept, Coordinating Draft,* Volume 3, 6 November 2002, Chapter 6, p. 32.

[4] TRADOC Pamphlet 525-3-90, *O&O Change 1, The United States Army Objective Force Operational and Organizational Plan Unit of Action,* 25 November 2002, p. 4-68.

[5] *Maneuver Support Operational Concept,* p. 32.

[6] TRADOC Pamplet 525-3-90, p. 4-2.

[7] TRADOC Pamplet 525-3-90, p. 4-5.

[8] *Maneuver Support Operational Concept,* p. 33.

[9] Ibid., pp. 33-34.

[10] Ibid., p. 34.

[11] *Intelligent Munitions System Operational Employment Concept Paper and Briefing,* Final Draft, U.S. Army Engineer School, Fort Leonard Wood, Missouri 65473, 23 October 2002.

[12] TRADOC Pamphlet 525-3-90, pp. 4-15, 4-38, 4-68, 4-73, 4-74, F-8, F-32, F-37, F-43, F-62.

[13] *Operational Requirements Document for the Future Combat Systems, Change 2 (Army Requirements Oversight Council Approved),* Unit of Action Maneuver Battle Lab, Fort Knox, Kentucky 40121, 22 January 2003, p. 39.

[14] *Maneuver Support Operational Concept,* p. 34.

[15] John L. Romjue, *American Army Doctrine for the Post-Cold War,* Washington D.C.: Center of Military History, 1997, p. 35.

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("Stryker Brigade," continued from page 11)

focused on attacking the enemy—not reacting to the enemy's impediments.

The SBCT provides a window for us to see the future of organizations and mobility. Its design is a balance between responsiveness and capability.[6] The focus of balance and mobility on the design is evident in the embedded engineer company. While smaller than the current mechanized formation, the embedded engineer company has significant mobility enablers. In some missions, the SBCT—like any organization—will need engineer augmentation. The challenge is to design scalable augmentation forces that can precisely meet the unit's need for those specific missions. A doctrinal approach that recognizes situational understanding as a fundamental enabler will help define those packages. This approach will leverage the design and doctrine of the SBCT and augmenting forces to successfully shape future organizations.

The SBCT is an organization that is preparing for tomorrow's operations, which provides us with insight to the tools that will be used in future organizations. The Engineer School will use the lessons and emerging doctrine of the Stryker Brigades to help shape the dialogue of the future, while capitalizing on their presence to improve our Regiment today and in the days and years to come.

Endnotes

[1] FM 3-0, *Operations,* 14 June 2001, Chapter 7.

[2] *Organizational and Operational [O&O] Concept for the Interim Brigade Combat Team [IBCT],* 30 June 2000, Chapter 1.6.

[3] Ibid., Chapter 9.1.

[4] Major Anthony O. Wright, *Concept and Organization of the IBCT Engineer Company,* Engineer, May 2001, pp. 6-9.

[5] *O&O Concept for the IBCT,* Chapter 9.1, 1.

[6] Ibid., Chapter 1.8.

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Operationalizing Assured Mobility

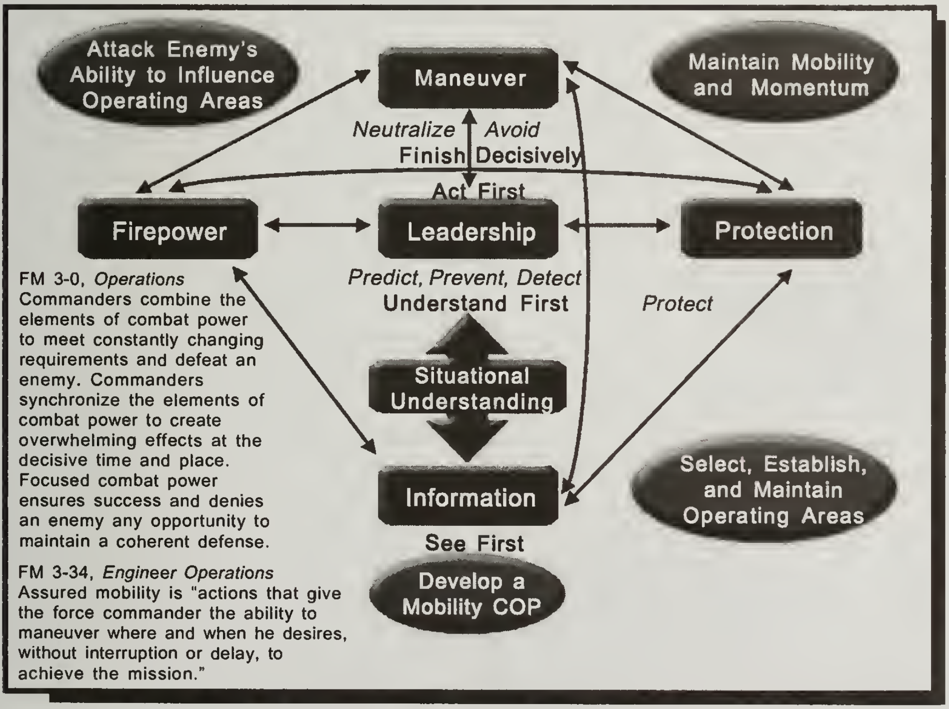
By Lieutenant Colonel Jeffrey A. Bedey and Major Ted Read

The assured mobility framework enables increased situational understanding to yield increased freedom of maneuver as it ties together the elements of combat power for existing and future formations. The framework is a proactive thought process that is not tied to equipment capability, but rather is a way to systematically refine the combined arms assets available to assure maneuverability of the decisive force. Essentially, the framework enables Legacy, Interim, and Objective Force units to harness situational understanding as a fundamental enabler to attack the threat before he impedes our ability to maneuver.

To recap, the assured mobility framework was originally developed to leverage information and the other elements of combat power to determine mobility requirements for the Objective Force (see Figure 1). As an analysis tool, it is very successful in ensuring that mobility requirements are adequately defined in the Objective Force Organizational and Operational Plan for the unit of action. Essentially, it is an exemplar that enables units to proactively identify "predict-to-detect," "detect-to-prevent," and "predict-to-prevent" linkages to generate superior situational understanding and focus on the maneuverability of the decisive force. The key is to build these linkages to prevent the threat from affecting our ability to maneuver and protect ourselves from the threat's effects.

The current Legacy/Interim Force assured mobility framework definition is "actions that give the force commander the ability to deploy, move, or maneuver where and when he desires, without interruption or delay, to achieve his intent." The framework of assured mobility entails four imperatives (see Figure 2, page 16):

- *Develop the mobility common operational picture (COP).* Gain improved situational understanding geographically by using geospatial tools to combine improved intelligence, surveillance, and reconnaissance (ISR) capabilities with terrain data and an integrated reconnaissance and surveillance to help the commander visualize the battlefield.
- *Establish and maintain operating areas.* Identify enemy engagement areas (EAs), named areas of interest (NAIs), targeted areas of interest (TAIs), choke points, operating areas, and lines of communication (LOCs) connecting those areas in order to determine enemy capability and intentions.
- *Attack the enemy's ability to influence operating areas.* Allocate combat power and sensors to negate the threat's efforts to impede maneuverability. In addition, secure our ability to maneuver where needed (operating areas, LOCs, TAIs, and EAs),
- *Maintain mobility and momentum.* Synchronize all Battlefield Operating System (BOS) capabilities to protect and sustain our established ability to maneuver when and where we wish, enabling us to maintain pressure and lethality despite the threat.



FM 3-0, *Operations*
Commanders combine the elements of combat power to meet constantly changing requirements and defeat an enemy. Commanders synchronize the elements of combat power to create overwhelming effects at the decisive time and place. Focused combat power ensures success and denies an enemy any opportunity to maintain a coherent defense.

FM 3-34, *Engineer Operations*
Assured mobility is "actions that give the force commander the ability to maneuver where and when he desires, without interruption or delay, to achieve the mission."

Figure 1. Assured Mobility Framework

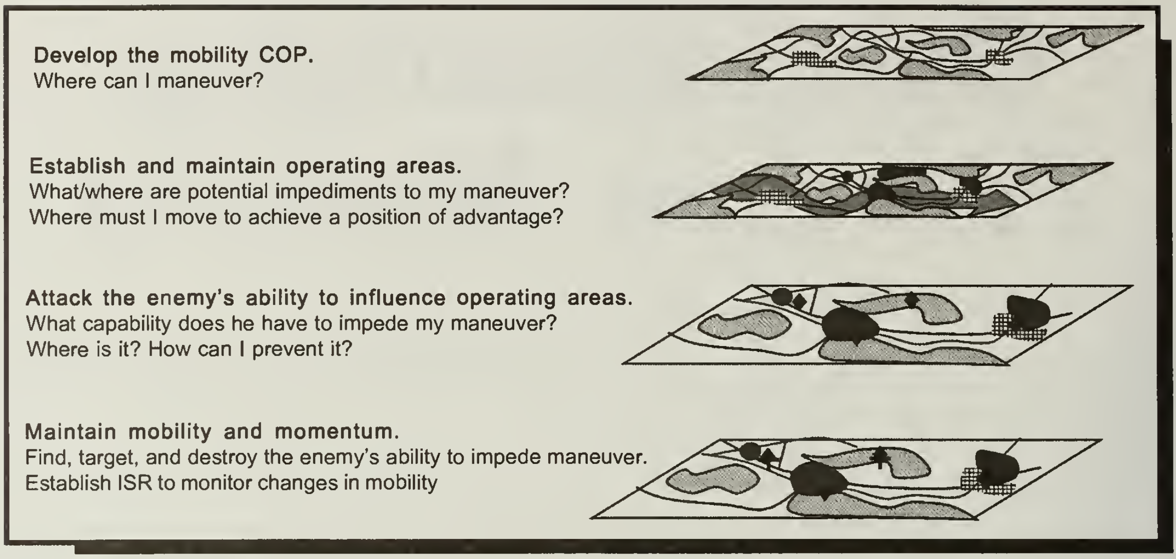

Develop the mobility COP.
Where can I maneuver?
Establish and maintain operating areas.
What/where are potential impediments to my maneuver?
Where must I move to achieve a position of advantage?
Attack the enemy's ability to influence operating areas.
What capability does he have to impede my maneuver?
Where is it? How can I prevent it?
Maintain mobility and momentum.
Find, target, and destroy the enemy's ability to impede maneuver.
Establish ISR to monitor changes in mobility

Figure 2. Assured Mobility Imperatives

The assured mobility fundamentals tie the imperatives together and must be proactively viewed from two perspectives (see Figure 3). The six fundamentals are:

- *Predict* actions and circumstances that could affect maneuverability.
- *Detect* early indicators of impediments to battlefield mobility.
- *Prevent* potential impediments to maneuverability from affecting battlefield mobility of the force. A key is to develop predict-to-prevent linkages to detect impediments and identify alternative mobility corridors needed to . . .
- *Avoid* battlefield impediments.
- *Neutralize*, reduce, or overcome impediments (from traditional mines to industrial chemicals) that cannot be prevented or avoided.
- *Protect* against the effects of enemy impediments. Successful application of assured mobility analysis is gained through a sequential and continuous application of the fundamentals throughout the imperatives en route to, on, and beyond the objective.

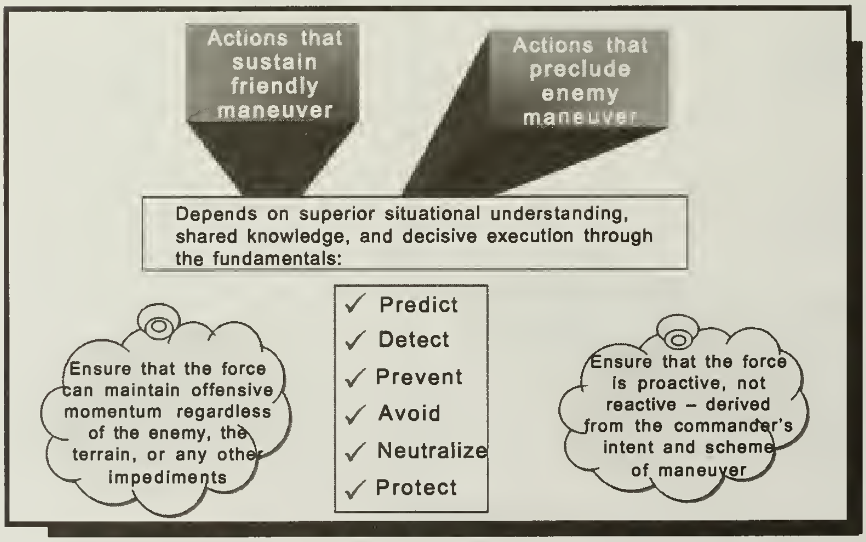

Actions that sustain friendly maneuver
Actions that preclude enemy maneuver
Depends on superior situational understanding, shared knowledge, and decisive execution through the fundamentals:
✓ Predict
✓ Detect
✓ Prevent
✓ Avoid
✓ Neutralize
✓ Protect
Ensure that the force can maintain offensive momentum regardless of the enemy, the terrain, or any other impediments
Ensure that the force is proactive, not reactive – derived from the commander's intent and scheme of maneuver

Figure 3. Assured Mobility Perspectives

The linkage of assured mobility to FM 3-0 begins with information—the newest element of combat power. FM 3-0 refers to information as an element that "...enhances leadership and magnifies the effects of maneuver, firepower, and protection."[1] Later, the manual describes information superiority as the "...force being able to *see first*, *understand first*, and *act first*."[2] These additions to FM 3-0 were a concrete start to enabling the information edge within the operational art as foreseen by Generals Frederick Franks, William Hartzog, and Gordon Sullivan in the U.S. Army Training and Doctrine Command (TRADOC) Pamphlet 525-5, *Force XXI Operations*.[3]

Assured mobility is a model that enables commanders to see first, understand first, act first, and finish decisively from a mobility perspective. Furthermore, when used as a layered system of proactive refinement in complex environments, it can provide a way to enumerate the amount of combined arms assets required to assure freedom of maneuver of the decisive force. The definition of "provide assured mobility" in the Objective Force shifts to "...actions that guarantee ..." from "...actions that give...," and it becomes an imperative to our future BOS as "provide assured mobility."[4] (See article on page 12.) In the Objective Force, we will *guarantee* freedom to maneuver through a system-of-systems approach that capitalizes on embedded standoff capabilities. Until the assured mobility system of systems is built, proofed, fielded, and embedded, the Army must maximize existing combined arms capabilities to *give* mobility to the maneuver commander. To that end, assured mobility provides a framework that helps transform increased situational understanding into decisive maneuver. Essentially, the assured mobility framework is the transmission that transfers power from the elements of combat power to the wheels of time, space, and purpose within the operational framework.

An example of doctrinal application today is how the U.S. Army Engineer School is helping the Stryker Brigade Combat Team (SBCT) leadership maximize its capabilities to provide mobility to the decisive force. Assured mobility was the centerpiece of an interactive practical exercise that proactively used enhanced situational understanding and situational awareness to build linkages among the assured mobility fundamentals to enable maneuverability. Assured mobility provides the SBCT leaders a framework to mobility solutions by addressing a few considerations (listed below) to help focus their analysis of the fundamentals against each imperative. The analysis was shaped to ensure that both an enemy and friendly perspective were accounted for en route to, on, and beyond the objective.

- *Develop the mobility COP.*
  - √ Leverage terrain and reconnaissance technology to determine mobility corridors, defensible terrain, and choke points.
  - √ Determine who is using what mobility corridor and why.
  - √ Predict when, where, and why the enemy will maneuver.
  - √ Develop a sensor web and reconnaissance plan to confirm enemy maneuver.
- *Establish and maintain operating areas.*
  - √ Determine friendly operating-area needs.
  - √ Identify key terrain, and implement an ISR plan to support mobility.
- *Attack the enemy's ability to influence operating areas.*
  - √ Allocate combat power to attack the enemy's ability to influence the maneuverability of the decisive force.
- *Maintain mobility and momentum.*
  - √ Predict, detect, and then prevent the enemy from using situational obstacles, and when prevention fails, avoid or breach/bridge obstacles as necessary.
  - √ Maintain multiple routes to enable maneuver flexibility.
  - √ Anticipate and allocate assets to reduce civil/cultural impacts.
  - √ Anticipate and prevent the use of toxic industrial chemicals and weapons of mass destruction.
  - √ Counter enemy reinforcement attempts.

The SBCT leadership used the considerations to focus the discussion within a continuous and sequential analysis of the assured mobility fundamentals to successfully tie FM 3-0's see first, understand first, act first, and finish decisively to physical assets owned by the maneuver commander. The result was an innovative and proactive application of information enablers and combat units to ensure the mobility of the decisive force in complex and urban terrain specific to that mission.

Assured mobility is a framework leaders can use to envision the elements of combat power in allocation of assets to multiple engagements in time, space, and purpose. The SBCT leadership has proven that the assured mobility framework contributes to the freedom to maneuver for existing Legacy and Interim Force formations—not just the Objective Force. The key to implementing assured mobility is altering thought processes from reactive-centric to proactive-centric methods that build decisive maneuver linkages with the assets available.

The hard part may have been said best by Sir Basil Liddell Hart in *Thoughts on War, 1944* "...that the real challenge is not to put a new idea into the military mind but to put the old one out..."[5] Assured mobility provides a new idea to help the commander maximize information, in conjunction with the other elements of combat power, to achieve decisive results within an operational framework. Assured mobility is how a maneuver commander can, as envisioned in FM 3-0, enhance the elements of combat power and build successful engagements within time, space, and purpose.

Endnotes

[1] Department of the Army, FM 3-0, *Operations*, Washington, D.C., 14 June 2001, p. 4-10.

[2] Ibid., p. 11-2

[3] Department of the Army, TRADOC Pamphlet 525-5, *Force XXI Operations, A Concept for the Evolution of Full-Dimensional Operations for the Strategic Army of the Early Twenty-First Century*, Washington, D.C., 1 August 1994, p. 1-3.

[4] TRADOC Pamphlet 525-3-25, *The United States Army Objective Force Maneuver Support Operational Concept, Coordinating Draft*, v1.3, 6 November 2002, Chapter 6, p. 32.

[5] TRADOC Pamphlet 525-5.

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Major Read is an instructor/writer in the Department of Instruction, U.S. Army Engineer School, Fort Leonard Wood, Missouri. He was previously an engineer observer/controller at the Combat Maneuver Training Center, Hohenfels, Germany, and commanded C Company, 9th Engineer Battalion, 1st Infantry Division, in Schweinfurt, Germany. He has deployed to operations in Somalia, Haiti, the Balkans, and Afghanistan.

ENGINEER OFFICER EDUCATION TRANSFORMATION

By Lieutenant Colonel Jeffrey A. Bedey and Major Storm E. Reynolds

On 4 February 2003, the Army announced significant changes to the Officer Education System (OES). These changes seek to provide the right education, in the right medium, to the right leader at the right time and place. Just as the Army transforms to the Objective Force to meet the challenges of the 21st century security environment, so too must the Army transform its education system to train and educate the leaders who will command and control that force.

The U. S. Army Engineer School at Fort Leonard Wood, Missouri, has been a leader in every facet of OES transformation. One of the keys to our success has been the many ideas, comments, and concerns from the field. Much of the feedback is incorporated into the Engineer School's transformation strategy. The latest initiatives and changes to the way we will train our engineer officers are captured in the following paragraphs.

After the Basic Officer Leader Course (BOLC), junior officers will no longer move through broad-based educational gates based solely on a time frame. But, when officers move into a new staff job or into command, they will receive specific institutional training that is tailored to the skill sets necessary to succeed in that position (see Figure 1).

The current Officer Basic Course will transform into BOLC. This course will ensure a tough, standardized, small-unit leadership experience that flows progressively from precommissioning (BOLC I) to initial-entry field leadership experience, a 6-week training experience held at a centralized location (BOLC II). The final component of the course will be branch technical/tactical training, an 11-week program held in residence at the proponent school (BOLC III). Current plans are for BOLC to be fully implemented in the 3d quarter fiscal year (FY) 06.

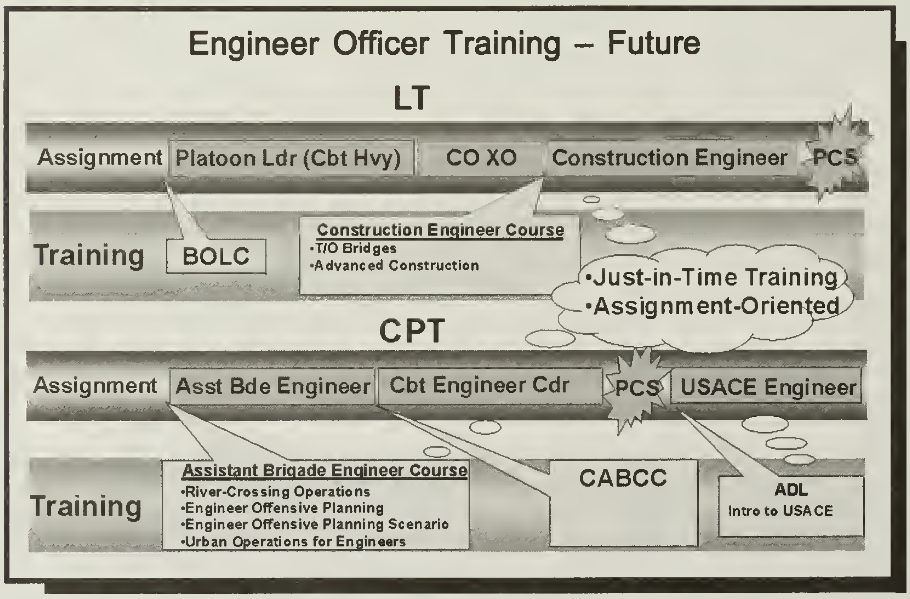

Figure 1

Training beyond BOLC will consist of the Combined Arms Staff Course (CASC) and the Combined Arms Battle Command Course (CABCC). These two courses will replace the existing Captain's Career Course and the Combined Arms and Services Staff School. The changes in the OES will provide institutional training that is tailored to a specific job in a way that is expertly packaged and provides more frequent training for shorter periods. This will allow the mind to better absorb and understand concepts and thus increase overall retention and depth of knowledge. Exposure to multiple and diverse jobs will provide breadth to an officer's knowledge.

The CASC is designed to train staff officer skills. The diversity of the Engineer Regiment requires multiple assignment-oriented training opportunities for its officers. With that concept in mind, the Engineer School developed a modular concept for the CASC built around six engineer staff/technical courses:

- Assistant Brigade Engineer
- Assistant Division/Corps Engineer
- Task Force Engineer
- Geospatial Manager
- Construction Engineer
- U.S. Army Corps of Engineers (USACE) Engineer

All six courses will include advanced distributed learning (ADL) and intense resident experiential training. The officer's initial CASC course will include a 2-week common-core ADL, followed by a 1-week functional ADL module, and then a 2-week resident phase. The resident experience is the vehicle by which the officer will demonstrate a mastery of knowledge gained through completion of ADL. The experiential training will immerse the officers in simulations, history-based vignettes, and progressive problem-solving situations related to developing the skill sets required of the position.

These courses will provide assignment-oriented training just in time for a staff duty position. The construct of this design allows engineer officers to receive training before assuming a staff/technical position anywhere along their career path. The six courses have some foundational knowledge in common, which is organized into modules. This commonality allows for reduced training time as officers receive the foundational knowledge in the first course attended. Subsequent courses will not repeat this baseline but will build on it to train the unique skills and knowledge for that course. For instance, an officer can take the fourteen required ADL modules for the Construction Engineer Course but only have to take five additional course-unique ADL modules to complete the Assistant Brigade Engineer Course. The residential phase is still required, and the officer has an option to repeat modules if desired. Current plans call for the implementation of CASC for 3d quarter FY05 (see Figure 2).

As with the CASC, the Engineer School has developed a modular construct to train battle command skills in the CABCC. The curriculum in the proposed command course is divided into seven modules: take command, train, administer, maintain, deploy, fight, and lead. Each module will include both ADL and experiential training activities that focus on company command. Leaders and officers in the field will also benefit from the modular design. The time an officer spends completing his ADL will be more focused, and leaders will be able to provide more focused mentorship, which should result in a more meaningful and rewarding learning experience for junior officers. The course will culminate with a 2-week combat training center experience, which will expand upon training management skills. Current plans will implement CABCC in 2d quarter FY06.

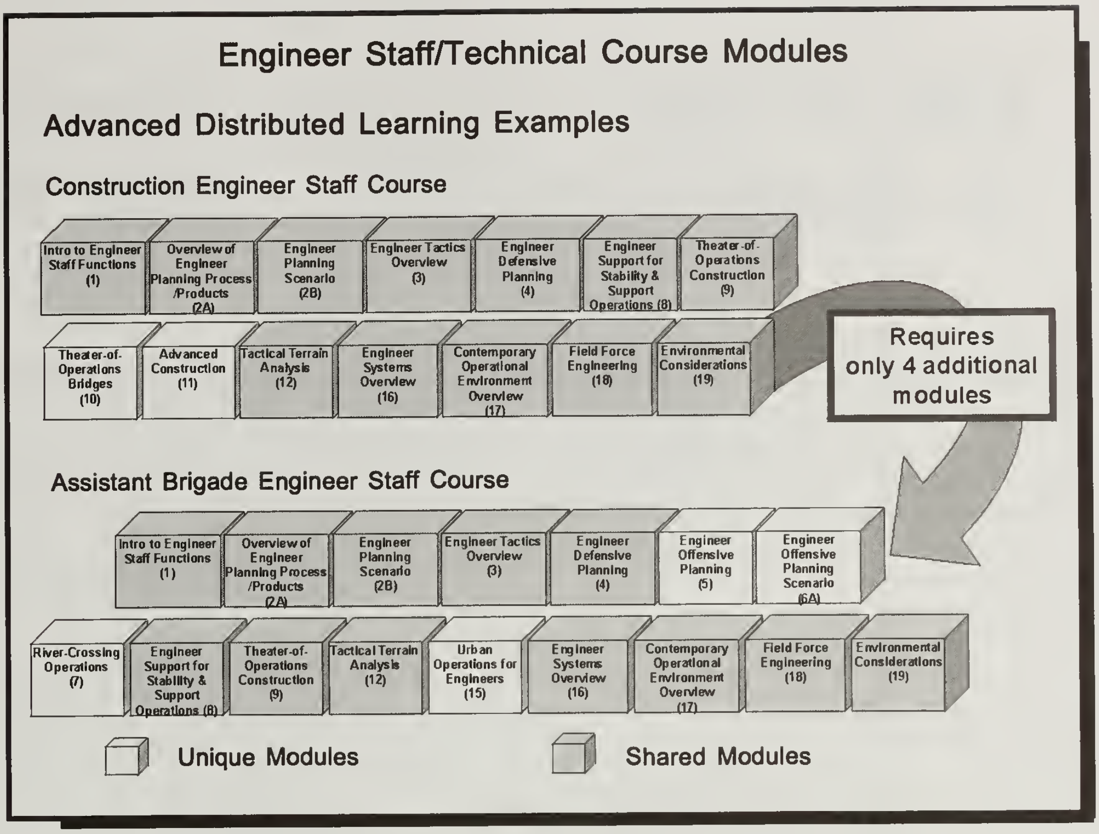
Engineer Staff/Technical Course Modules
Advanced Distributed Learning Examples
Construction Engineer Staff Course
Intro to Engineer Staff Functions (1)
Overview of Engineer Planning Process /Products (2A)
Engineer Planning Scenario (2B)
Engineer Tactics Overview (3)
Engineer Defensive Planning (4)
Engineer Support for Stability & Support Operations (8)
Theater-of-Operations Construction (9)
Theater-of-Operations Bridges (10)
Advanced Construction (11)
Tactical Terrain Analysis (12)
Engineer Systems Overview (16)
Contemporary Operational Environment Overview (17)
Field Force Engineering (18)
Environmental Considerations (19)
Requires only 4 additional modules
Assistant Brigade Engineer Staff Course
Intro to Engineer Staff Functions (1)
Overview of Engineer Planning Process /Products (2A)
Engineer Planning Scenario (2B)
Engineer Tactics Overview (3)
Engineer Defensive Planning (4)
Engineer Offensive Planning (5)
Engineer Offensive Planning Scenario (6A)
River-Crossing Operations (7)
Engineer Support for Stability & Support Operations (8)
Theater-of-Operations Construction (9)
Tactical Terrain Analysis (12)
Urban Operations for Engineers (15)
Engineer Systems Overview (16)
Contemporary Operational Environment Overview (17)
Field Force Engineering (18)
Environmental Considerations (19)
Unique Modules
Shared Modules

Figure 2

The current Command and General Staff College (CGSC) will change to Intermediate Level Education (ILE). All majors will attend 12 weeks of common-core operational instruction. An additional phase of up to 28 weeks will be provided to meet the requirements and needs of officers in their respective career field and/or functional area. Current plans are for ILE to be fully implemented by 4th quarter FY05.

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FM 3-34, *Engineer Operations:* A Blueprint to Forge Our Future

By Lieutenant Colonel Anthony C. Funkhouser

In the last few years, the world has been transformed, with new threats to our nation requiring a broader range of military missions, new technologies for our armed forces, and a new National Security Strategy. The Army took these matters into account as it established new doctrine, beginning with Field Manual (FM) 1, *The Army*, and FM 3-0, *Operations*. This iteration of doctrine was developed more systematically and, for the first time, linked Army doctrine to joint doctrine. The new numbering system also reflects this change. FMs 1 and 3-0 are the capstone manuals and, as such, are at the pinnacle of the doctrine hierarchy from which all other Army manuals descend. Additionally, FM 3-0 is written at the operational level of war, relating doctrinal principles that will enable senior commanders to fight full-spectrum operations and campaigns. It lays out the doctrinal frameworks, tenets, and principles for senior leaders to consider when fighting over extended time and space. As the Regiment's capstone manual, the doctrinal principles within FM 3-34, *Engineer Operations*, were derived from FM 3-0. Like a blueprint, FM 3-34 will provide the foundational principles that will forge the Regiment's future at the operational level of war.

To understand where we will go with FM 3-34, we should understand its history and relationship to FM 3-0 (formerly FM 100-5). The origins of engineer operations doctrine can be traced back to the first edition of FM 5-100, *Engineer Operations*, published in 1979. This version of FM 5-100 melded two other engineer manuals, FM 5-135, *Engineer Battalion Armored Mechanized and Infantry Divisions*, and FM 5-136, *Airborne Division Engineer Battalion*, both published in 1961. These two manuals focused solely on the principles and tactics, techniques, and procedures for battalion commanders operating in a division (tactical level). Coming just after the 1976 edition of FM 100-5, *Operations*, this 1979 version of FM 5-100 addressed common themes of divisional engineer operations against a Cold War threat. The manual (again written at the tactical level) explained how the engineer functions of mobility, countermobility, survivability, and topographic and general engineering support the maneuver commander. Since then, FM 5-100 has been revised four more times, three of which were in direct response to revisions of FM 100-5 (see table above).

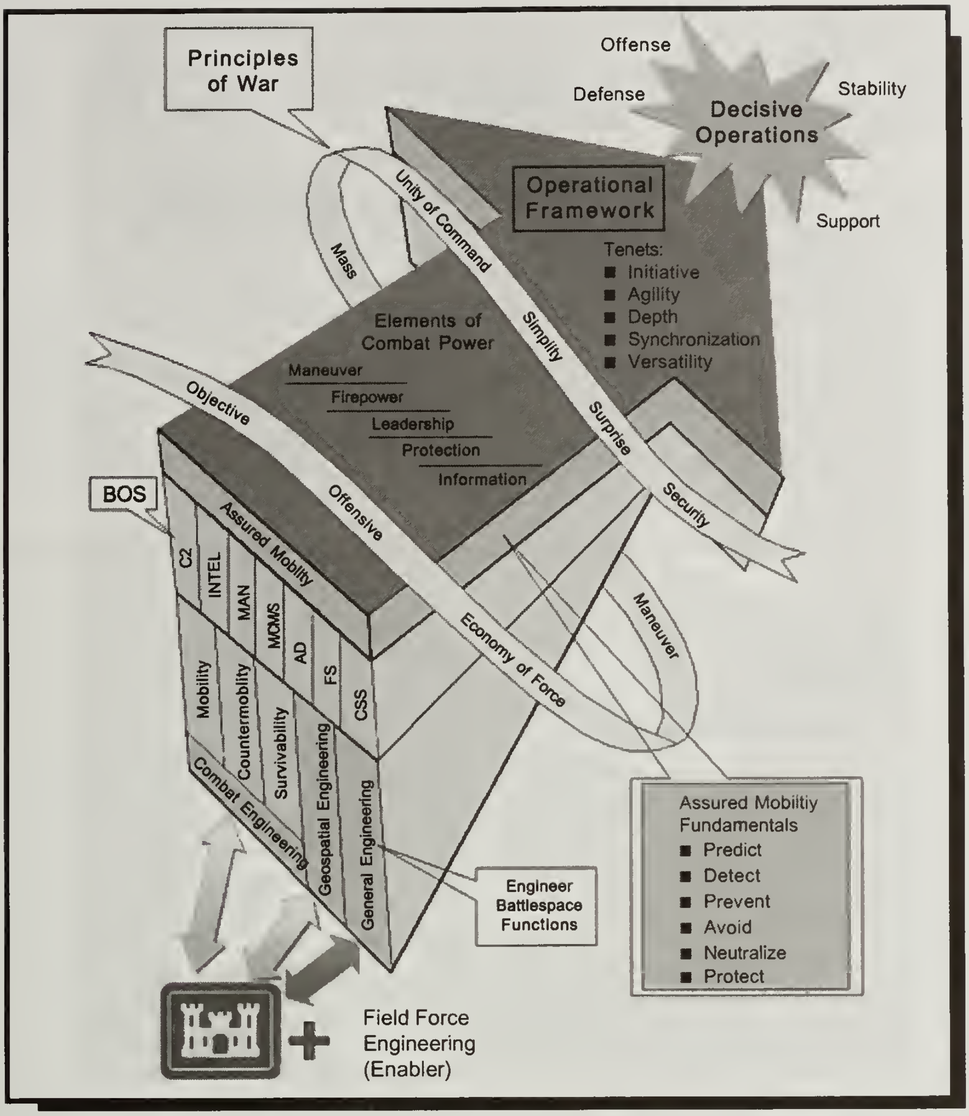
The revisions of each of these manuals are indicative of changes to organizations, equipment, and how the Army was to fight. However, the enduring principles of war did not change. It was not until the Army began to think of how to train and participate in military operations other than war that new doctrinal principles began to emerge. The current version of FM 3-0, published in June 2001, addresses participation in the full spectrum of operations (offense, defense, stability, and support) in noncontiguous areas of operations and the impact of a new operational environment. Throughout the process of developing this new doctrine, principles of war endured. The authors of FM 3-0 also established an operational framework, integrating elements of combat power, principles of war, and Army tenets to achieve decisive operations. It is this framework that provides the basis of all discussions in FM 3-0 and, therefore, other manuals in the doctrinal hierarchy.

FM 100-5, *Operations*	FM 5-100, *Engineer Operations*
1968	1961 (FM 5-135/136)
1976	1979
1982	1982
------	1984
1986	1988
1993	1996
2001 (FM 3-0)	2003 (FM 3-34)

Publication dates of capstone manuals

The U.S. Army Engineer School's Doctrine Development Division has taken this framework into consideration, along with feedback from senior engineer leaders in the field, and has started drafting a new FM 3-34. To maintain integrity with higher-order manuals and to create the parameters from which the manual could be written, this manual integrates the engineer functions, responsibilities, and principles addressed in joint publications and our Army capstone manuals. These parameters give us the latitude to address our advances in how we will fight the Regiment and serve as the foundation for all other engineer manuals.

FM 3-34 provides many firsts for the Corps of Engineers. First, the manual weaves a theme of engineer operations at the operational level of war throughout the entire manual. Second, it describes new threats in the operational environment and the implications to engineers around the Regiment. Third, it expands upon the role of the Regiment. It specifically discusses how the entire Regiment contributes to operational-level



Assured Mobility Within the Operational Framework

commanders and how the Regiment interacts with all of its various engineer organizations to support the Army's senior-level commanders. Toward this end, we propose a regimental mission essential task list (METL) to support the Army's METL. Establishing a common engineer METL is another means to tie the Regiment together. Last, but certainly not least, is the center of gravity for this manual. The figure above, which is excerpted from the manual, takes the operational framework described in FM 3-0 and explains how the engineer functions support this framework, through the assured mobility subframework we recently published.

The manual uses this amalgamation to establish the relationships of the assured mobility imperatives and fundamentals to the elements of combat power within the operational framework. It should facilitate maneuver commanders' understanding of what assured mobility does for them, as it is explained within the context of their operational structures. It also shows how field force engineering enables engineer functions throughout the Regiment and expands our capabilities down to the point of the spear.

In FM 3-34, we try not to regurgitate doctrine from other manuals but rather refer the reader to the source document. Also, we steer away from tactical-level discussions that will be addressed in other manuals. FM 3-34 does not directly address the Objective Force, but by integrating a number of principles and introducing frameworks such as assured mobility and capabilities such as field force engineering, it provides the foundation for future doctrine focused on the Objective Force.

As you can see, FM 3-34 is different than previous editions, and those with a vision for the future of the Regiment will appreciate the contrast. It is critical to the Regiment that we are tightly linked to Army doctrine so we are not overlooked and made irrelevant. Therefore, it is very important that we get feedback from the field and make this an interactive process as we come to closure and publication.

In draft form, FM 3-34 was posted to the Army Knowledge Online (AKO) collaborative Web site (Army KCC Home/ Army Communities/TRADOC/Engineer/Engineer School/

Directorate of Training/Doctrine) for feedback until 21 March 2003. The comments were integrated for a coordinating draft and posted to the AKO Web site on 4 April 2003. This version will be used to discuss the manual and identify areas for modification.

The Engineer School plans to publish and distribute FM 3-34 by the end of FY03. The manual will be the foundation and blueprint for future engineer manuals. In the next year, the Doctrine Division will take the principles in FM 3-34 to revise our next tier (engineer functions) of manuals as follows:

- FM 3-34.1 (FM 90-7 and FM 5-102), *Combined Arms Obstacle Integration*
- FM 3-34.2 (FM 90-13-1 and FM 5-101), *Combined Arms Breaching*
- FM 3-34.112 (FM 5-103), *Survivability*
- FM 3-34.250 (FM 5-104), *General Engineering*
- FM 3-34.230 (FM 5-105), *Geospatial Engineering*
- FM 3-97.13 (FM 90-13), *River Crossing Operations*
- FM 3-34.32 (FM 20-32), *Mine/Countermine Operations*

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Letter To The Editor

Planning Engineer Support for an Urban Attack

I originally wrote "Planning Engineer Support for an Urban Attack" (published in *Engineer,* July 1998, and reprinted in *Engineer*, January-March 2003) to provide options with the technology and doctrine fielded to table of organization and equipment engineer units. Since I left the Joint Readiness Training Center, the Army has developed new doctrine and equipment to address some of the challenges I discussed. We have learned well from our experiences in the Balkans and Afghanistan. Notably, the sensor arrays now in development through the Infantry Center and in testing with the Special Operations Forces community mitigate the need for explosive entry during precision-strike military operations on urbanized terrain (MOUT). Remotely controlled breaching equipment has improved mobility and reduced the need for explosive breaching in many cases. Unmanned aerial vehicles and improved intelligence dissemination systems have greatly improved our situational awareness, reducing the need for "brute force" approaches. Indeed, the entire Army is making great strides in addressing the MOUT challenge.

Given that the world continues to urbanize, we must continue to develop new techniques to meet a wide range of MOUT tactical problems. Lieutenant Colonel Funkhouser and Major Kirkton ("Doctrinal Changes in Urban Operations," *Engineer*, January-March 2003) rightly state that we have an obligation to reduce collateral damage as a way to protect civilians and maintain legitimacy for our operations in the host nation. I would add that the complex three-dimensional battlespace of a large city, such as Seoul or Baghdad, presents a broad range of tactical problems for the maneuver commander—high population density, complex terrain, and dispersed-but-lethal military opponents. The supporting engineer soldiers have a responsibility to prepare a broad range of solutions to these tactical problems, some of which may be quite destructive. For example, explosive mine clearing may be appropriate in engagement areas like urban parks, and explosive-entry techniques may be required to gain access to enemy-held buildings. The Israeli-Palestinean conflict provides rich examples of improvised obstacles supporting small groups of determined opponents and demonstrates that excessive force can have significant unintended consequences. We must balance the risk of collateral damage with mission accomplishment, force protection, and proportionality. Excessive force risks escalation and violates the principles of legitimacy and restraint that are the foundation of successful smaller-scale contingency operations.

In any case, good mobility/survivability support contributes to maintaining initiative and momentum. Detailed mobility/survivability planning and preparation is essential in every environment. It must address the needs of the entire tactical force—from tooth to tail. Resupply and ground casualty evacuation routes, movement corridors for armored support forces, and a variety of assembly areas must be thoroughly planned and resourced. Engineer support to dismounted infantry platoons and companies in urban environments must remain prepared to clear a variety of reinforcing obstacles, including breaching buildings.

This is a superb discussion topic that should rightly take place in the pages of our professional publication.

Major John DeJarnette

THE COUNTERMINE CENTER FORCES AHEAD

By Mr. Eric Johnson and Colonel Jeffrey P. LaMoe

> *"The enemy will fight asymmetrically. He cannot face us frontally and will come at us from the side and in the gaps he can find. My challenge is always loss of momentum. If I can keep momentum, he will stay off balance and have to fight my fight. The area where loss of momentum is always greatest is in crossing gaps and breaching complex obstacles. Any piece of ground that stops us takes away the initiative. A great challenge. Having an adequate countermine program is a level-of-confidence issue and one of our key responsibilities."*
>
> *—General Eric K. Shinseki*
> *Chief of Staff of the Army*

Since Operation Desert Storm, U.S. military missions have spanned the spectrum of conflict. Those who oppose U.S. interests and objectives acknowledge that their forces would not survive a direct confrontation with our forces in conventional war. With U.S. involvement in a conflict, direct combat actions become less frequent as opponents disperse their forces and adopt tactics, techniques, and procedures (TTP) designed to offset our advantages. The effectiveness of this approach has been demonstrated repeatedly.In Chec hnya, forces confronted with numerically or technologically superior opponents also realized that they must operate in complex terrain and urban environments to offset the advantages of their adversaries. Analyses reveal that our potential adversaries believe that denial of regional access can dictate the tempo of conflict to the U.S. disadvantage. Adversaries understand that if they attack our alliances and coalitions, they can delay the start of decisive operations and dictate the strategic tempo by frustrating U.S. and allied access.

The current force is trained, equipped, and organized to breach complex linear obstacles intended to shape the battlefield. The Army's countermine capabilities were developed to breach linear obstacles. With few exceptions, all current countermine equipment in our inventory employs one of three strategies: metal detection or mechanical or explosive "brute-force" neutralization. While this is a critical capability that must be maintained, recent experience in multiple operations demonstrates that there is a distinct need to *clear* mines from an area, not just breach.

The Army is not organized—and has very few organic assets—to detect and neutralize mines for area and route clearance operations. We cannot clear routes at operational speeds; technology will not support it. We must bridge the current countermine capabilities gap with commercial off-the-shelf (COTS) equipment to conduct operations in the contemporary operational environment (COE) for the Legacy and Interim Forces until countermine equipment that meets our required countermine capabilities is fielded to the Objective Force.

However, the COE—with adaptations by potential adversaries to offset U.S. advantages—is leading conflict toward nonlinear, simultaneous operations conducted throughout the depth of the area of operations, using conventional and unconventional means oriented on the destruction of U.S. national will and weakening international support.As in the a ttack on the Khobar Towers in Saudi Arabia in 1996, adversaries have added new depth to the battlespace. They have demonstrated that they clearly understand the political value of attacking soft targets when they are unable to achieve success in conventional operations.

In January 2002, the U.S. Army Maneuver Support Center (MANSCEN) began to establish a Countermine/Counter Booby Trap Center (CMCBTC) at Fort Leonard Wood, Missouri, as the "go-to" Center of Excellence for all things having to do with countermine.

The requirement for a CMCBTC is the result of the challenges presented by the extreme proliferation of mines, booby traps, and unexploded ordnance (UXO) in the COE. The challenges have been intensified by the employment of improvised explosive devices (IEDs), side-attack mines, and command-detonated devices. Potential adversaries have learned that they no longer have to achieve military victory; instead, a way to achieve success is to avoid defeat while inflicting casualties on U.S. and allied personnel. This is an effective way to attack political will and popular support for military operations. Demonstrated repeatedly over the last decade, taking hostages, using civilians as "shields," using mines as instruments of terror, and using IEDs for ambushes have proven very effective. From southern Lebanon to Oklahoma City, from the Balkans to Latin America, mines and explosive devices in the hands of renegades have been successful in making our superpower military feel helpless and ill-prepared.

The CMCBTC was created to help remedy the current shortfall in mine/countermine training that currently exists in the Army. The center's goals are to—

- Integrate, not duplicate, countermine and counter-booby trap doctrine, organization, training, materiel, leadership, personnel, and facilities (DOTMLPF) issues and solutions.
- Develop expertise in countermine and counter-booby trap techniques to detect and defeat booby trap and mine threats and enhance mobility and force protection in the COE.
- Maintain superiority in all facets of countermine warfare, including resident and reach-back technical capabilities.
- Focus the science and technology community on developing new technologies to counter the mine and booby trap threats that support countermine technologies for Objective Force assured mobility.

Today the CMCBTC is well on its way to establishing itself as a fully resourced Center of Excellence, which will become the recognized leader in countermine and counter-booby trap training and technology. The center will focus and synchronize aggressive countermine exploitation of present and emerging mine and explosive threats, enhance countermine interoperability and hazard awareness with the combined arms, and develop DOTMLPF solutions and TTP for integrating newly developed or COTS equipment into countermine operations.

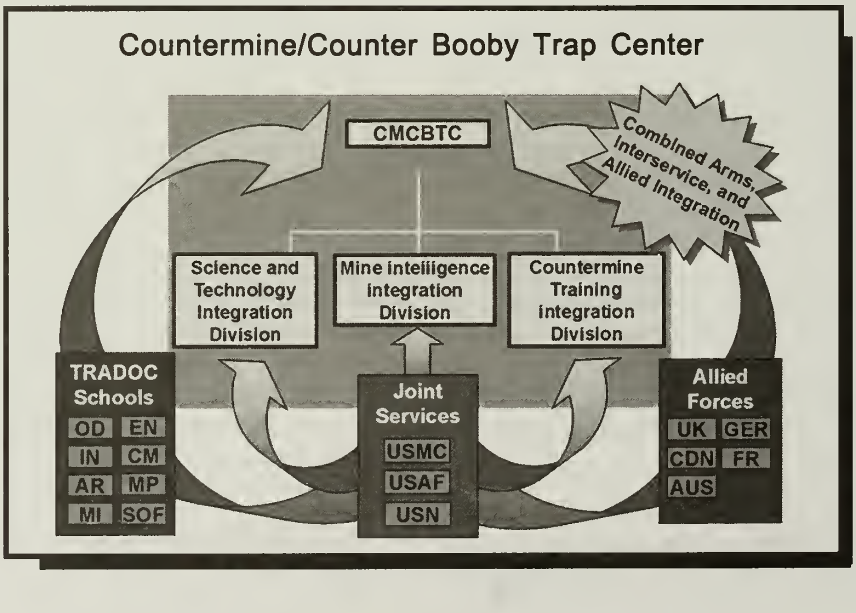
Many organizations are trying to help solve the explosive hazard problem; this synergy of effort did not exist previously. The focus of the CMCBTC's efforts this past year centered on interfacing and integrating countermine issues and solutions with other U.S. Army Training and Doctrine Command schools, allied forces, and joint services. This past year has also shown an increased awareness of the challenges in the countermine environment and initial integration of effort across branches, services, and Department of Defense agencies. The figure below shows the number and scope of organizations with involvement and interest in countermine.

The CMCBTC, working in concert with the MANSCEN Directorate of Combat Developments, developed a specification for a standard minefield database linked to Geographic Information System (GIS) tools to track and graphically display minefields and hazard areas. This effort, dubbed the Tactical Minefield Database (TMFDB), is being developed through the Topographic Engineering Center (TEC), Alexandria, Virginia—the government lead for the Maneuver Control System (MCS)-Engineer (MCS-E)—and Northrop Grumman, TEC's software development lead for MCS-E. The TMFDB will be forward-compatible with the beta release of MCS-E, which is scheduled for FY03.

The TMFDB resulted from urgent requirements emanating from Operation Enduring Freedom to develop a database of minefield and explosive hazard information. This initiative provides Coalition Joint Task Force 180 the ability to capture explosive hazard data and print georeferenced minefield maps and tactical decision aids to support the mobility and force protection of the force.

The TMFDB is relational, versatile, and customizable. The database will operate on a host unit's local area network, permitting near-real-time sharing of hazard data among U.S. elements. Friendly and enemy obstacles are assigned obstacle numbers based on the obstacle-naming convention in Field Manual (FM) 90-7, *Combined Arms Obstacle Integration*, and hazard locations will be displayed on tactical map backgrounds using color schemes and symbology shown in FM 101-5-1, *Operational Terms and Graphics*, and Military Standard (MILSTD) 2525B, *Common Warfighting Symbology*.

The TMFDB and GIS software can track and display point, linear, and area obstacles, minefields, and explosive hazards. Built as a subset of MCS-E, the application is being designed to interface with the command and control personal computer (C2PC) and MCS-Light and to input and output the minefield database to multiple formats (for example, the UN-approved Standard Information Management System for Mine Action [IMSMA]). The CMCBTC is presently demonstrating TMFDB capabilities to U.S. forces in Afghanistan and Kuwait.


Countermine/Counter Booby Trap Center
CMCBTC
Combined Arms, Interservice, and Allied Integration
Science and Technology Integration Division
Mine Intelligence Integration Division
Countermine Training Integration Division
TRADOC Schools
OD
EN
IN
CM
AR
MP
MI
SOF
Joint Services
USMC
USAF
USN
Allied Forces
UK
GER
CDN
FR
AUS

The past year has been demanding for the CMCBTC Countermine Training Integration Division. The CMCBTC developed mine awareness, engineer-specific countermine and counter-booby trap training to prepare forces for Operation Enduring Freedom. The CMCBTC also trained more than 4,000 soldiers and qualified more than 100 instructors at Fort Leonard Wood and various other locations (eleven mobile training teams in the continental United States [CONUS] and three outside CONUS [OCONUS]). Recently, nine CMCBTC personnel were deployed to Germany, Kuwait, and Afghanistan for countermine predeployment and on-site training.

In addition, the CMCBTC—along with the National Ground Intelligence Center, Charlottesville, Virginia, and the Navy Explosive Ordnance Disposal Technical Center, Indian Head, Maryland— developed two handbooks that describe common explosive hazards, their doctrinal usage, recognition features, immediate action drills, reporting, countermeasure equipment, and TTP to deal with these threats. One handbook, which is titled *Land Mine and Explosive Hazards Reference Guide*, concerns Afghanistan. The second one is the *Soldier's Handbook, Land Mines and Explosive Hazards–Iraq*. The CMCBTC also developed a detailed Training Circular (TC) 20-32-5, *Commander's Reference Guide, Land Mine and Explosive Hazards (Iraq)*.

Our current practice, in response to urgent circumstances, does not fit the "train-alert-deploy" model; instead, it is "alert-deploy-train." We need to emphasize common soldier skills training in mine awareness, detection, avoidance, and extraction, and develop combined arms strategies across Battlefield Operating Systems. The CMCBTC proposes the five functional courses shown in the table below to enhance and integrate individual and combined arms skills and to ensure that we have requisite skill sets trained before deployment. Funding is needed to support the functional training courses until the FY05 budget submission establishes funds for a throughput of 400 students per course.

The U.S. Army requires a mine-detection-dog program to support Operation Enduring Freedom and the Objective Force and to reduce the risk to soldiers. Mine-detection dogs are the only tool we have to identify mines and explosive hazards based on the chemical odor of the explosives used in these devices.

In August 2002, the U.S. Army Engineer School Assistant Commandant briefed the Vice Chief of Staff of the Army and the Army Requirements Oversight Council on the school's solutions for dealing with the countermine threat. They approved funding for the Operation Enduring Freedom area and route clearance sets, but not a CONUS-based training set. Approved items include mine-clearing armor-protected (MCAP) dozers, berm sifters, medium flails, mine-detection-dog teams, flares, weight-dispersion boots, interim vehicle-mounted mine detectors, and mine-protected vehicles.

Included in the briefing was the establishment of a mine-detection-dog unit, which was approved and funded. After careful research, it was decided that the British Army can best train the baseline requirements the U.S. Army needs for its mine-detection-dog capability. The first squad and the detachment sergeant were transferred to Fort Leonard Wood,

Countermine Functional Courses

Course	Description
Countermine Course	Will provide joint service and combined arms leaders with an understanding of countermine operations and equipment and will advise commanders on force protection, area clearance, route clearance, and maneuver and attack missions. It will also train personnel on COTS and Legacy Force equipment.
Counter-Booby Trap Course	Will teach knowledge- and technical-based tasks that support detection, identification, marking, recording, reporting, extraction, and neutralization of booby traps on the battlefield.
Urban Breacher Course	Will provide individual training for Department of Defense and Department of Justice personnel. The course will teach advanced urban breaching operations, explosive theory, planning combined operations, safety issues, urban reconnaissance, employment of urban breaching assets, and breaching techniques for urban operations. It will also train personnel on COTS and Legacy Force equipment. We are working with the Marine Corps to exploit their current course (joint training).
Master Countermine Course	Will provide training to noncommissioned officers (E-7 and above) with battle staff qualification and officers (lieutenants, captains, and majors) to increase the planning capability of joint service and combined arms staff personnel in mobility tasks influenced by mines, booby traps, and UXO. The course will enable staff personnel to establish a mine information and coordination cell within an operational headquarters and advise commanders on all countermine TTP, including force protection, area clearance, and route clearance. It will also train liaison skills for operations with coalition forces, United Nations, nongovernment organizations, private volunteer organizations, and demining organizations.
Unexploded Ordnance Reconnaissance Agent Course	Will teach non-explosive ordnance disposal (EOD) soldiers to conduct initial procedures to mitigate the hazards of UXO, booby traps, and IEDs.

future home of the mine-detection dogs, and are awaiting orders to the United Kingdom for training. Training is expected to begin in May 2003. Training for mine dogs is 24 weeks long.

Mine-detection dogs give Army engineers an additional tool for countermine operations—a tool last used in the Army during the Vietnam conflict. Today's planned detachment will have an offensive capability similar to that of the Vietnam-era units. However, the threat today is very different and complex. Dogs have performed civilian humanitarian demining missions for more than a decade, but the U.S. Army requires more than just that capability. This new unit will be breaking ground with TTP and doctrine for the military countermine dog. In fact, this unit will be trying to advance procedures used by other armies. The U.S. Army mine-detection-dog unit will be the world's most advanced dog unit.

It will take almost three years to field this unit of 30 dogs. The time delay is because the U.S. military has no training capability for mine-detection dogs and will have to stand up a trainer base while the unit stands up. The British Army has a small training base and the CMCBTC will be taxing it to the fullest in support of our efforts.

The Engineer School is addressing the area clearance shortfall with updated doctrine, training support plans, and TTP and certified instructors to help train our Army for ongoing and future area clearance operations.

Mr. Johnson is the lessons learned researcher in the Countermine/Counter-Booby Trap Center, Fort Leonard Wood, Missouri. He holds a master's in computer resources and information management from Webster University in Saint Louis, Missouri, and is a graduate of the U.S. Army Command and General Staff College.

Colonel LaMoe is the Director of Training, U.S. Army Engineer School, Fort Leonard Wood, Missouri. Previous assignments include senior combat engineer trainer, Sidewinder 07, National Training Center, Fort Irwin, California, and deputy commander, 555th Combat Engineer Group, Fort Lewis, Washington. He holds a master's from Michigan State University and a master's in strategic planning from the U.S. Army War College.

Regimental Awards

Each year we recognize the best noncommissioned officer, lieutenant, and engineer company, in each of the components, for outstanding contributions and service to our Regiment and Army. Every engineer unit in the Regiment can submit the name and achievements of its best of the best to compete in these distinguished award competitions. Only the finest engineer soldiers are selected as recipients of these awards. They will carry throughout their careers the distinction and recognition of being the Engineer Branch's best and brightest soldiers and leaders. Following are the results of the 2002 Active Component Itschner and Grizzly Awards and Sturgis Medal selection boards:

The Itschner Award committee selected the U.S. Army Europe nominee—Company C, 9th Engineer Battalion (C), 1st Infantry Division Engineer Brigade, Schweinfurt, Germany, APO AE 09033—as the 2002 winner.

The Grizzly Award Committee selected First Lieutenant Michael White, Company A, 54th Engineer Battalion (C) (M), Bamberg, Germany, APO AE 09139, as the 2002 winner.

The Sturgis Medal committee selected Sergeant First Class Bradley J. Schneier, Company B, 54th Engineer Battalion (C) (M), Warner Barracks, Germany, APO AE 09139, as the 2002 winner.

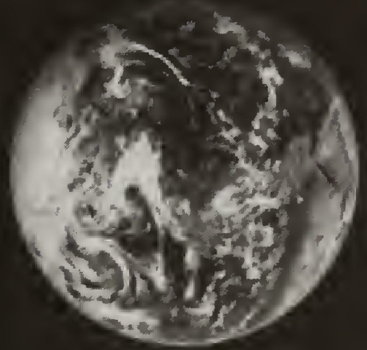
All of the nominees represented their major commands with the highest professionalism and dedication to the Engineer Corps's vision and deserve our highest praise. The award recipients will be recognized at the U. S. Army Corps of Engineers Ball, tentatively scheduled for 23 October 2003.

For many years, senior leaders of the Regiment have debated about an appropriate award to recognize the very best engineer soldier, private through specialist. In keeping with the tradition of naming such an award after a distinguished member of the Regiment, the Regimental Command Sergeant Major, along with other senior sergeants major, recommended and gained approval for an award named after the most distinguished command sergeant major in the history of our Regiment—the fourth Sergeant Major of the Army, Leon Van Autreve.

The award is extremely significant for two reasons: first, it was created to recognize the most outstanding junior enlisted soldier of the three components of our Regiment as a tribute to one of our Army's greatest champions of welfare and care of soldiers and their families; second, it showcases and highlights the important and significant service our junior enlisted soldiers provide to our nation. They are truly our most valued resource, and we wouldn't be the Army or Regiment that we are without their selfless and dedicated service. The Van Autreve nominations will be submitted for FY03 and presented at ENFORCE 04.

Lieutenant General Robert B. Flowers
Chief of Engineers

Major General R.L. Van Antwerp
Commandant, U.S. Army Engineer School



OPERATION ENDURING FREEDOM:

A WAYPOINT TOWARD GEOSPATIAL ENGINEERING TRANSFORMATION

By Chief Warrant Officer 3 David Kasten

In early December 2001, I was just settling down in Kosovo—doing my part toward fulfilling the 10th Mountain Division's Kosovo Force (KFOR) rotation—when I received a call to go to Afghanistan to support Central Command's (CENTCOM's) Operation Enduring Freedom. So I packed up and moved out, leaving a three-man element deployed in support of KFOR. The other personnel from our detachment remained at Fort Drum, New York, supporting the rear commander and performing force protection missions.

Terrain Team Mission

My unit, the 66th Engineer Detachment (Terrain), works for the 10th Mountain Division assistant chief of staff, G2 (intelligence), in support of the intelligence preparation of the battlefield (IPB). Being collocated with the G2 section is helpful in getting access to required geospatial information and imagery. However, due to our capabilities to rapidly visualize the terrain, we also stayed in the back pocket of the division chief of staff. Our main piece of equipment was the Digital Topographic Support System (DTSS)-Deployable (DTSS-D). We also had some augmentation equipment from the National Imagery and Mapping Agency (NIMA), headquartered at Bethesda, Maryland. Despite our small size and the austere environment in Afghanistan, we were still able to provide support to the division with on-demand, non-standard, unique terrain products in a timely manner.

The 10th Mountain Division had many successes during Operation Enduring Freedom. The terrain team supported the division during the deployment and was extremely successful during the planning and execution of Operation Anaconda. Adequate planning would not have been possible without the DTSS-D. The overall DTSS was christened during the combat operation. (To learn more about the DTSS, see the Topographic Engineering Center [TEC] Web site at *www.tec.army.mil.*) It enabled us to provide many tactical decision aids and other nonstandard products. Most engineers are familiar with the products we were asked to generate—elevation tints, shaded/painted relief maps, high-resolution image maps, multispectral image maps, combined-obstacle overlays, lines of communication overlays, hydrology overlays, limited map reproduction, perspective views using high-resolution imagery, threat domes, intervisibility products, and virtual fly-throughs. This may sound like "the short list," but every product was tailored to its intended user, and a lot of imagination from both the analyst and the user was required to make it useful.

One particular item we generated was the initial air insertion visualization product of the Shaikot Valley in southeastern Afghanistan. The aviation commanders needed to know what air routes were available from Baghram into the objective area of operation with specific cloud ceilings. These corridors had to be displayed using the Earth Resources Data Analysis System (ERDAS®) Virtual Geographic Information System (VGIS®), an invaluable commercial applications program included in the DTSS-D. Using the VGIS, the commander was given a better understanding of how rugged the terrain was and what options were available. After looking for air avenues with varying ceilings, the aviators and terrain technicians determined that the ceiling could not be less than 7,500 feet in order to use the corridors that were selected. The value of this information allowed premission decisions to be made by the division chief of staff in support of CENTCOM's overall mission.

Lessons Learned

The DTSS proved to be the right system to support warfighters of Operation Anaconda, aviation units, and division decision makers—it fulfilled its requirements. The many lessons we learned during this operation concerned things such as equipment challenges, the importance of maintenance, enhancements that the system should incorporate, understanding data and data limitations, new training we need, the importance of working closely with the G2 imagery section, the need to push software to users, and on-demand printing. Based on my recent experiences with the 10th Mountain Division, I will discuss these lessons in this article.

Equipment and Maintenance

Although it is labeled as a deployable system, the DTSS-D is geared more toward a garrison-type environment. Dust and heat will quickly render the system useless, and maintenance can't be stressed enough. The initial problem we had was that we were in a very dusty environment in Afghanistan, which took its toll on all our equipment. Saving factors were a good industrial vacuum cleaner and regular maintenance. Even then, we still lost the capability to output to soft mediums such as floppy, jazz, and digital video disks (DVDs) and compact discs-recordable (CD-Rs). Luckily, we brought extra (off-the-shelf) computers that had the same output capability that we connected through the DTSS.

The constant moving of systems also created havoc on external wires. We lost many small computer system interface (SCSI) cables and terminators and one power cable. These were mission stoppers. The bottom line is: gather spare parts prior to departure. The Department of Defense Manufacturing Technology (ManTech) Program, which provides DTSS contract support, will help obtain spare wiring.

Digital Topographic Support System-Deployable

It is important to understand the limitations of the system—both the hardware and software aspects of it. We thought we had a good handle on this until we really pushed the system. Bring your own networking tools, such as RJ45 (Internet) cable, testers, crimpers, and spare 6- to 8-port hubs. We need to take it upon ourselves to understand our systems so we can do our own basic troubleshooting.

Enhancements

We used VGIS exclusively in special operations mission rehearsals and quick-response force planning. This included helping users visualize their insertion route, extraction route, helicopter landing zones, and tactical operations. We used VGIS to visualize where the battle was taking place, determine mortar threat domes, build line of sight from known enemy and friendly locations, and assess possible exfiltration and infiltration routes from known enemy locations (commonly referred to as "rat trails"). However, VGIS would work even better if we incorporated a high-end graphics card to allow better resolution and larger-sized fly-throughs. Also, a better three-dimensional (3-D) fly-through program that could be rendered and flown in real time would be helpful in the future (such as Skyline's TerraExplorer Pro®).

Lack of Information

We sometimes take for granted that everyone understands the possible lack of geospatial information and the limitations of the data we use and require for geospatial analyses. As geospatial engineers, it is our responsibility to make our customers understand data accuracy and data resolution—for example, by creating line-of-sight or visible-area plots (360-degree line of sight) using Digital Terrain Elevation Data (DTED) Levels 1 and 2 or Shuttle Radar Topographic Mission (SRTM) Level 2. Very little vector data was available in December 2001. The terrain team extracted as much data as possible from 1:50,000 Russian maps, and then we used imagery for critical areas.

Training

Geospatial instruction taught in the U.S. Army Engineer School is only the basic building block. It's our responsibility to teach soldiers the reality of the field. We must give them realistic training, to include holding them to the time constraints we can expect in a high-tempo operation. Encourage creativity when producing a product, pass on the shortcuts we use when we produce products, and get soldiers to understand the mission of the customer. We have to prepare for the fact that we may have to deploy as a small element. We need to ensure that we cross train everyone from the bottom up, keeping in mind that the terrain technicians are still the experts. There will always be a learning curve to overcome, but there are basic items that must be addressed before any deployment. Following is a list of tasks with which all of us should be familiar. Most deal with computers, and many may think this is an assistant chief of staff, G6 (information management), function. This is correct, but if your G6 is as undermanned and overtasked as ours, you'll find that this knowledge will help cut out minutes, hours, or days of downtime. These skills include—

- Basic networking, such as setting up Internet protocol addresses for plotters, printers, and computers.
- Setting up gateways, workgroups, domains, and RJ45 cables, both standard and crossover; up-linking hubs.
- Basic computer operation and troubleshooting (including maintenance), such as file transfer protocol (FTP) and file allocation table (FAT) 16 versus FAT 32 versus New Technology (NT) file system.
- Understanding the common errors/problems/limitations with Environmental Systems Research Institute (ESRI™) ArcInfo®, such as missing information within vector coverages and inverted fly-throughs (VGIS).
- Understanding the problems/shortcomings of all data that is being used and being able to convey this to the customer.
- Understanding the IPB process better.

G2 Imagery Section

Understand the functions and limitations of your imagery section. The terrain team relied heavily on imagery during this operation. With the lack of standard maps, we filled the data gap by producing multiple image maps. Imagery was vital in producing products because NIMA maps that were available were at 1:100,000 scale and almost 20 years old. These did not provide the ground operator with enough information. Australia shared scanned Russian 1:50,000 digital maps that provided great detail but were still 15 to18 years old.

We created many updates using imagery provided from two main sources. The first was unclassified, high-resolution imagery that the TEC Imagery Library provided as soon as it was available. The second source was the NIMA support team (NST), formally called the Customer Support Response Team (CSRT), that provided high-resolution, georeferenced, classified imagery. The team could download current imagery (less than 30 days old) via the Secret Internet Protocol Router Network (SIPRNET) and could also create image maps. Later in the deployment, the NST brought its own dedicated satellite dish for connectivity, which improved the team's ability to download imagery that the division needed. Both sources were vital to the success of the mission.

One misconception many users have is that all imagery is accurate and precise; however, we found errors that were as great as 400 meters off of actual locations. Geospatial engineers must inform their users of the possible data inaccuracies.

National and Coalition Partners

There are many organizations that can assist us in just about every aspect of our job. During our deployment, we asked for assistance from ERDAS, ESRI, NIMA, TEC, ManTech, ILEX Systems (a software support contactor), and terrain units from the United States, Britain, and Australia. They all bent over backward to assist us; just like the old cliché, "no question is a dumb question."

Software and Data

Push terrain/map programs to the people we support. Give the tools and basic instructions to our customers. The programs that we pushed were Terrabase 2, FalconView™ , ArcExplorer®, ERDAS Viewfinder®, SID® Viewer, and screen-grabbing software. We also pushed as much raw data as possible, such as DTED, raster product format (RPF) images, and raster data. This helped eliminate the small taskings that we were constantly receiving. The training that the customers need to use these map programs will take some time, but the payoff in time saved in the future will be worth it.

Printing

One of the functions of the DTSS-D is low-volume map printing. Although this is a thorn in the side of many terrain detachments, it is also a great asset. Due to the lack of information on standard NIMA 1:100,000 maps, we turned to printing some of the Russian 1:50,000 maps. These maps had an abundance of information that was helpful to the ground operators, such as water velocity, bridge information, and road width. The most helpful information was that contours on these maps were 20 meters versus the 50 meters on the 1:100,000 maps. Because of this, the terrain team overlaid World Geodetic Survey 84 grids on the Russian 1:50,000 maps and reproduced more than 500 copies to support the ground operators.

Conclusion

The DTSS is a great system. It works in combat, it works in the field, and it works in garrison. There are aspects that can be improved, and I challenge the Engineer School to make that happen. The terrain warrant officer and 81T soldiers are in high demand. There are many customers in your organization beyond the traditional support to the IPB. In my case, the division chief of staff and the aviation and special operations forces were new and prized customers. No information set is going to be perfect—and may not even be good enough to use—but I used imagery to improve upon existing NIMA- and Soviet-produced maps. Finally, the best job is done in collaboration with NIMA, TEC, and our allies. We really have the interoperability built in to allow us to work together smoothly.

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Transforming Geospatial Engineering . . . Critical to Success of the Objective Force

By Colonel David A. Kingston, Lieutenant Colonel Steven H. Tupper, and Major Carl G. Herrmann

With the fielding of the Digital Topographic Support System (DTSS) and the increase in the size of terrain detachments in the heavy divisions and the Stryker Brigade Combat Team (SBCT), many changes in geospatial engineering have occurred over the past five years. These changes enabled significant improvements in geospatial engineering support to commanders and proved critical to success in recent combat operations. (The article on page 27 tells how the DTSS supported Operation Enduring Freedom.)

As successful as we are, our current capabilities still do not meet the total requirements for our Legacy and Interim Forces. Furthermore, the requirements for geospatial engineering support for the Objective Force will be even greater. This article explains how the geospatial community will transform to meet the needs of the Objective Force. It also covers deficiencies in the current force that must be fixed, what we see as the emerging geospatial requirements for the Objective Force, and the organizational and materiel system changes that are necessary to meet these requirements.

Current Force Support Deficiencies

One deficiency in the current force is a lack of accurate, robust, and timely geospatial data for worldwide missions. The possibility exists that a terrain team will not have the required terrain data to support a unit's mission and will have to acquire that data from an outside source or create it internally. The National Imagery and Mapping Agency (NIMA), headquartered at Bethesda, Maryland, is the primary outside source for our digital geospatial data and imagery. The problem commonly associated with this source is that the resolution is often insufficient (for example, Digital Terrain Elevation Data [DTED] Level 1 or 2, with 100- and 30-meter spacing), and it often takes too long for NIMA to provide the data. When terrain teams support operations, particularly special or airborne operations or military operations on urbanized terrain, high-resolution geospatial data (such as DTED and Imagery of 1 meter) is often required. Thus, to overcome the shortfall, terrain teams need to have the capability to generate their own geospatial data internally. The current DTSS suite of software tools has limited capabilities to rapidly generate geospatial data.

Another deficiency of the current topographic force is that the organizational structure is not designed for generation, management, fusion, and dissemination of digital data. The current organizations do not support the growing geospatial needs of the Army. A case in point is the topographic unit chain of command: units designed to task have no authority to task. For example, the production and control (P&C) team has the mission to manage P&C for an entire theater, but it has no authority over the underlying geospatial units. Additionally, there is an awkward relationship between the topographic battalion and the accompanying P&C team. While both are led by a lieutenant colonel, their lines of responsibility seem to be interwoven.

Finally, there is no distinct line of communication between the terrain team assigned to a brigade and units assigned at echelon-above-corps units. There is no established organizational structure that a terrain team can use to acquire new or updated terrain data from a higher-echelon support unit.

A further deficiency of the current structure is that there are still seven divisions in the active Army that have only a single nine-person terrain team assigned to them. Digitized divisions have 36 soldiers who support them and each maneuver brigade. This capability should not be limited to the digitized divisions; the nondigitized divisions can also make use of these larger terrain teams.

Objective Force Support Deficiencies

The Objective Force has a number of constructs that will cause it to fight in a manner completely and totally different than the way we fight current forces. These constructs include—

- *Use of knowledge as a substitute for armor and mass.* The Objective Force must see first and understand first to be successful. In the case of geospatial engineering, this will require an unprecedented amount of timely, accurate, and robust geospatial data to proactively understand the effects of terrain. This is particularly true if we are to accomplish the concept of assured mobility. In this case, knowledge of the terrain is part of the first of the four imperatives of the assured mobility concept. Our current organizational structure and materiel solution don't even come close to meeting this requirement. We can't rapidly generate data, and we can't manage data sufficiently.

- *Use of reach-back to minimize the footprint of deployed forces.* This requires robust home station operating centers (HSOCs) and high-capacity communications systems, plus the ability to fuse/conflate data from multiple sources. It also requires a capability to create a predictive geospatial tool that can be disseminated to soldiers for use in a stand-alone mode. None of these currently exist.
- *Emphasis on battle command.* Objective Force systems must have as their main focus the ability to support the commander wherever he may be to execute the art and science of command. Individual stovepipe systems will not work for the Objective Force. The current Army Battle Command System, which includes DTSS, does not meet this requirement. There must be organizational and system changes.

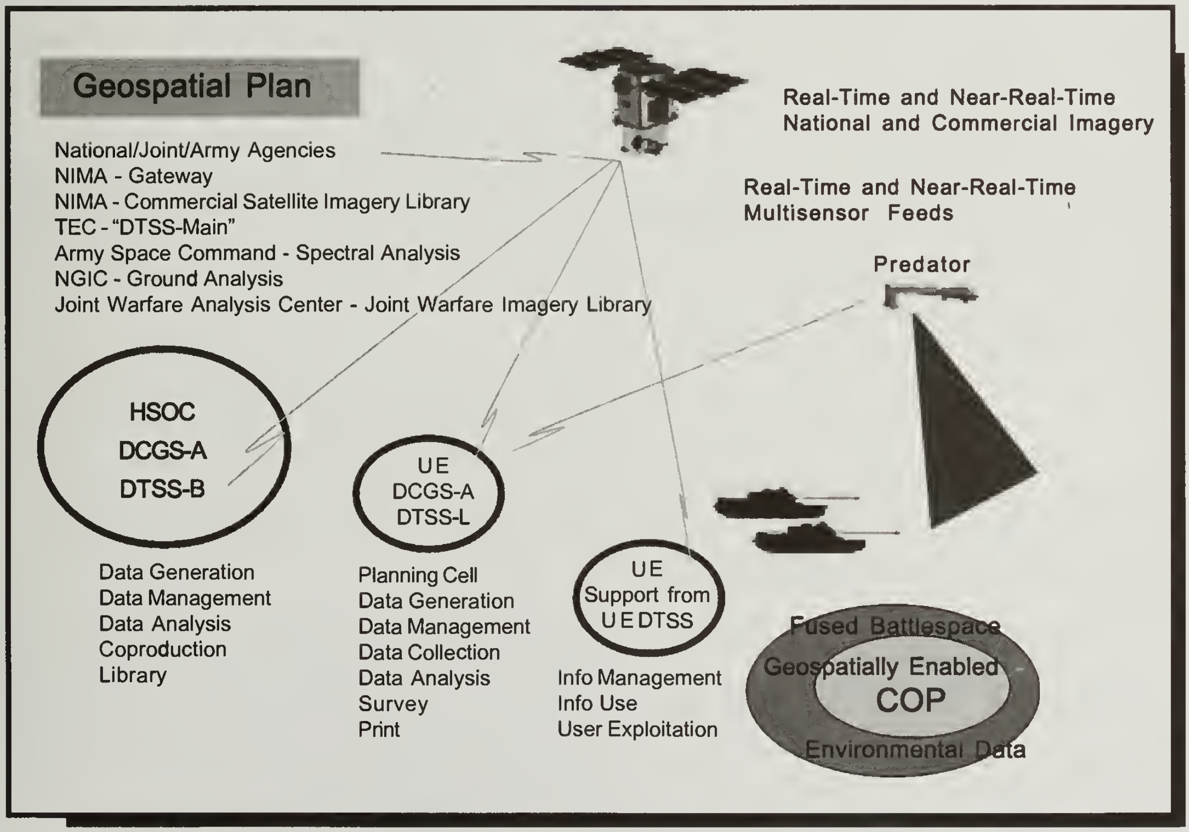
Objective Force Organization and Materiel Solutions

From the above, it is obvious that organizational and materiel changes are needed if the geospatial engineering community is to meet the requirements of both the current and Objective Forces. It is clear that the organization needed to support the Objective Force must have some capability at the unit-of-action (UA) level, a fairly robust topographic capability at the unit-of-employment (UE) level, and a very robust capability at the HSOC level. The organization must enable the critical missions of data generation, management, analysis, survey, and printing. The figure below shows the operational architecture that we believe is needed to make this work.

Table 1, page 32, shows the major teams that we envision will be put together as modules that will be able to execute at the UE and be plugged into the UA, should it need augmentation. Also shown is a geospatial planning cell at theater level that will have all of the capability needed for the entire theater (such as database management, conflation, and generation).

As far as the HSOC is concerned, we envision the Army's Topographic Engineering Center (TEC) at Alexandria, Virginia, as being the premier geospatial engineering center of excellence. However, TEC's current organization would need to be greatly expanded in size and capability to meet the Objective Force HSOC requirements.

The Objective Force will also require major upgrades to our primary system—the DTSS. This system, which we currently call DTSS-Objective Force (DTSS-OF), must be able to rapidly generate data from numerous sensors and sources, to include sensors in unmanned aerial vehicles (UAVs) and satellites and data sources from NIMA; the National Ground Intelligence Center (NGIC), Charlottesville, Virginia; TEC; etc. The Objective Force system must rapidly generate whatever data it needs to support specific missions. All this must be semiautomated in gathering data from whatever source is available, generating the data, and providing the smart



Geospatial Structure Based on Small-Unit Modules	
Geospatial planning cell	HSOC (joint-land component commander level) Theater
Geodetic survey	(UE level) Corps
Geospatial data collection/ cartography/printing	(UE level) Corps
Data generation	(UE level) Division
Data management	(UA and UE levels) Brigade
Geospatial analysis	(UA and UE levels) Brigade

Table 1

DTSS-OF Major Requirements/Capabilities

- Precision push of terrain information/intelligence to user
- Exploitation down to user/command and control system (command/joint mapping tool kit [C/JMTK]) by applets (terrain reasoning)
- Advanced inputs and outputs
- Intuitive visualizations
- Position navigation (POS/NAV) enabler
- Autonomous operations with little human intervention
- Predictive terrain analysis (course of action analysis, planning)
- Reach enabled; auto data mining (brilliant pull)
- Virtual/simulations data driver (battle simulation, mission rehearsal)
- Auto filtering and scaling of information
- Wireless
- Mounted and/or dismounted
- Artificial intelligence
- Generation of responsive terrain information (Multispectral Scanner and Data System [MSDS])
- Conflation of MSDS and national readiness terrain information
- Connectivity to the intelligence community (NIMA, NGIC, National Astronomy and Ionosphere Center [NAIC], National Reconnaissance Office [NRO])
- Integration of output with DCGS-A (IGI)
- Leverage of Army Space Command – commercial imagery
- Exploitation of all sources and sensors
- Addition of new data types (ground photo, video, audio)
- Sensor tasking and control
- Data collection, including sensors and platforms (engineer-dedicated UAV feeds)
- Update of terrain information
- Certification and control of terrain information sets to guarantee a COP
- Map service responsibilities
- Geospatial database and products database
- Ability to perform at joint level when command-designated as joint task force
- Builder of exploitation applets
- Adaptive/complex analysis
- Overlay early warning/threat/environment (weather) impacts

Table 2

geospatial database (logic "network") that will eventually be sent to each system platform. It must seamlessly provide data to other Objective Force systems, such as the Distributed Common Ground System-Army (DCGS-A), the Objective Force Battle Command System, and the Future Combat System. This Objective Force geospatial system will provide unparalleled capabilities to understand the terrain and provide the foundation for the Objective Force common operational picture (COP). Table 2 shows the major requirements of the Objective Force geospatial system.

Conclusion

In conclusion, the transformation of geospatial engineering began in the late 1990s with the fielding of the DTSS and the increase in size of the geospatial teams. This transformation has already brought great success in current operations. However, the current DTSS and organization structure still does not meet all of the requirements that will be needed to support the Objective Force. The organizational and materiel solutions presented in this article will serve as the road ahead in overcoming these deficiencies and allow the Objective Force to see first and understand first. Additionally, we will develop the changes in doctrine, training, leader development, and facilities needed to bring about those solutions. Our efforts will be closely coordinated with those of other members of the community (such as NIMA, the Battle Command Battle Laboratory, the Military Intelligence School, and TEC). The future of the geospatial community and the Engineer Regiment has never been brighter.

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Major Herrmann is the command, control, communications, computers, intelligence, surveillance, and reconnaissance (C4ISR) project leader for the materiel team, Directorate of Combat Developments (Engineer Division), U.S. Army Maneuver Support Center, Fort Leonard Wood, Missouri. He holds a master's in business administration from Indiana University of Pennsylvania.

Terrain Visualization Systems: Rapid Path to Terrain Understanding

By Mr. Ken Bergman

In the mid-1990s, an Army warrant officer in Korea flew his helicopter north of the demilitarized zone and was shot down. He flew north of the border because he was unfamiliar with the terrain, and he became lost. Joint Task Force –Korea responded by purchasing a mission-rehearsal system called Tactical Operational Scene (TOPSCENE™), a software package that used elevation data with imagery draped over it to provide a three-dimensional (3-D) terrain fly-through, with annotations and labels on key terrain features. The software facilitated night flying because it showed scenes as they would appear using night-vision goggles. The system provided Army helicopter pilots the technology to rehearse missions in Korea many times before ever getting into the cockpit. The Army paid about half-a-million dollars for this high-end TOPSCENE capability, which was supported by a refrigerator-sized workstation. Databases had to be built and maintained by contractors. Although terrain warrant officers could update the databases, this required nonstandard training, and rotation of trained personnel made in-house database generation a challenge. However, the capabilities gained by having this system at Joint Task Force–Korea were extremely useful.

The cost of computers has decreased significantly, and many high-end Unix®-based workstations have been replaced by Windows®-based personal computers (PCs). Today's high-end laptop can easily compare with yesterday's refrigerator-sized workstation in terms of processing capability and speed. Software has rapidly evolved to leverage the new, powerful PCs. There are now literally hundreds of terrain visualization systems that use imagery draped over elevation data to provide 3-D terrain fly-through capabilities.

Terrain Visualization Systems Capabilities

Terrain understanding is a key aspect of warfare. Thousands of years ago, Sun Tzu said that knowing the terrain is a significant advantage on the battlefield. This axiom has not changed. Tactical decision aids built by the Digital Topographic Support System (DTSS) are very useful tools to achieve terrain understanding; for example, the modified combined-obstacle overlay is a tool that is familiar to all topographic engineers. Tactical decision aids are typically used in a two-dimensional (2-D) presentation, either digitally or as hard-copy products. Terrain visualization systems, on the other hand, provide a bird's-eye view of the terrain, to give the user another way to achieve terrain understanding.

Terrain visualization systems use elevation data to provide a basic understanding of the lay of the land (such as hills, valleys, plains, and escarpments). More detailed elevation data provides a better terrain understanding, but it also requires higher data storage and processing capabilities. Imagery or digitized raster maps are draped over the elevation data to display terrain features. As with elevation data, more detailed imagery provides better terrain understanding, but this comes with a data storage and processing cost.

Many terrain visualization systems have additional capabilities:

- Display radar domes and surface-to-air missile threat domes.
- Drape vector (feature) terrain data over elevation data and imagery.
- Add landmarks and signposts for improved orientation.
- Page in more detailed images or maps as you fly closer to the ground.
- Extrude (stand up) buildings to show detailed urban terrain data.
- Render the scene to look like a night-vision or infrared scene.
- Export stand-alone files to any PC for 3-D fly-through capability.
- Interface with battle command systems.

The last two points listed here merit some elaboration, since they are key aspects in the utility of terrain visualization systems.

Export Stand-Alone Files to Any PC

This aspect refers to the recent phenomenon of high-end terrain visualization systems being able to export a file that can run without any software license support. Figure 1, page 34, shows five leading terrain visualization systems that are being used in the field. DTSS Imagizer, TerraExplorer®, and TerraVista® are systems that are capable of exporting stand-alone files to "any PC" (for example, a mainstream Pentium® computer purchased in the last couple of years). The process of building and using terrain visualization data in Figure 1 starts with *source data* (elevation, feature, and urban data and imagery), *data preparation* (processing the data to provide a smooth fly-through), *viewer* (type of file or software used to display the data), and *data interchange* (data interoperability from the system to other systems). The capability to export stand-alone terrain visual-ization files makes it possible to provide unlimited copies of compact disks (CDs) or digital video disks (DVDs) to soldiers, who can load the files on their laptops at no cost. This is a huge technology breakthrough that the Army needs to leverage more effectively.

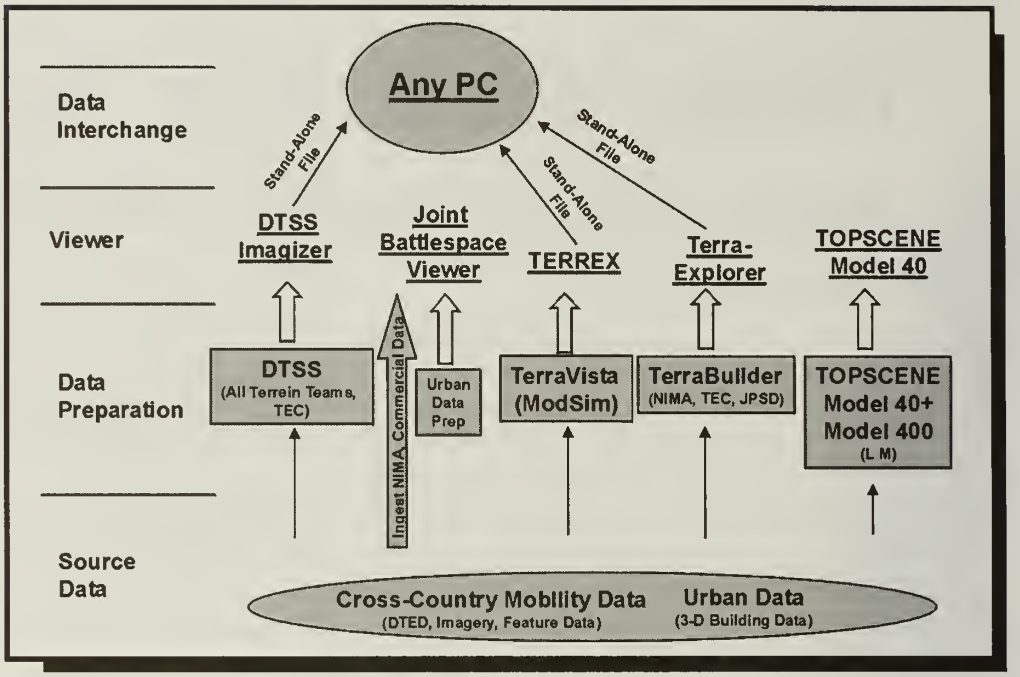


Figure 1. Export Stand-Alone File to Any PC

Interface With Battle Command Systems

Interoperability with battle command systems is another key capability for terrain visualization systems. The acquisition community has developed the Army Battle Command System (ABCS) to achieve command and control in the field. Windows-based systems in the ABCS can use stand-alone 3-D fly-through files (see Figure 2). This figure also shows that products from DTSS can be exported to ABCS workstations using the DTSS overlay provider.

The ABCS is being fielded to numerous units, but fiscal limitations have precluded fielding to all units. Some field units have obtained systems on their own to achieve battle command functionality. Command and control personal computer (C2PC) is a popular government off-the-shelf (GOTS) battle command software package being used by the Army. It uses the media gateway controller (MGC) or "magic" file to display overlays (such as fire support control measures). The Advanced Deep Operations Command and Control System (ADOCS), another popular GOTS battle command system (see Figure 3), can be used to ingest shape files from the DTSS and export MGC files to C2PC. A new software patch in the DTSS enables direct export of MGC files from DTSS to C2PC.

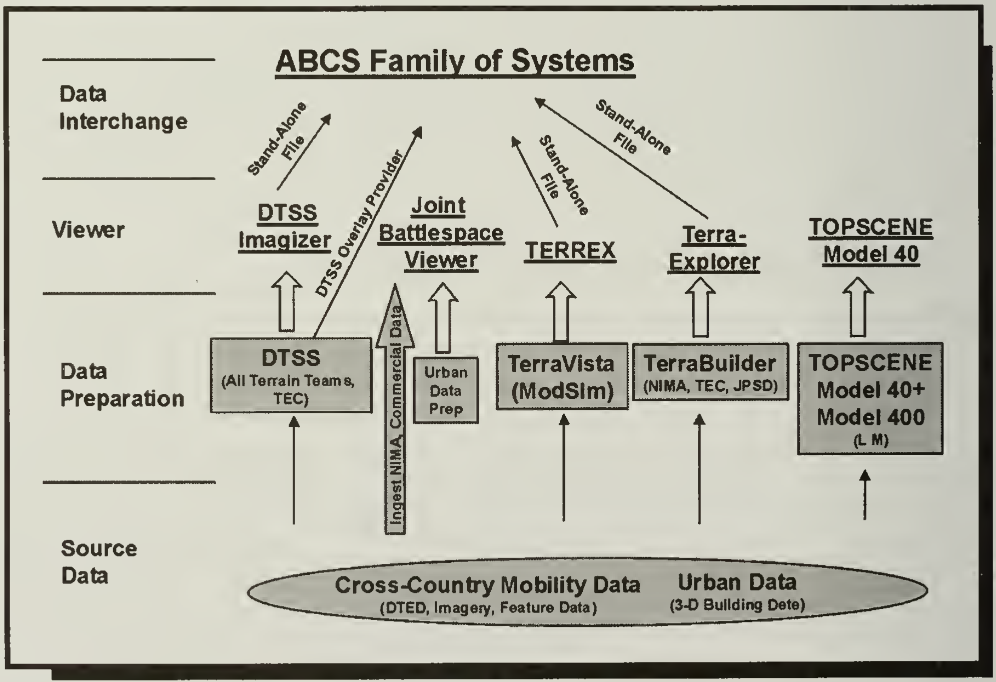


Figure 2. ABCS Terrain Visualization Data Flow

Terrain Visualization Categories

Terrain visualization data can be categorized into two types:

Cross-Country Mobility Data

This terrain visualization data is derived by draping imagery or digitized maps over elevation data. There is some level of elevation data and imagery available over the entire planet, and it is possible to provide some rudimentary level of terrain understanding anywhere in the world.

Urban Data

Urban data is built by extruding buildings, based on an estimation of building heights from image shadows, blueprint

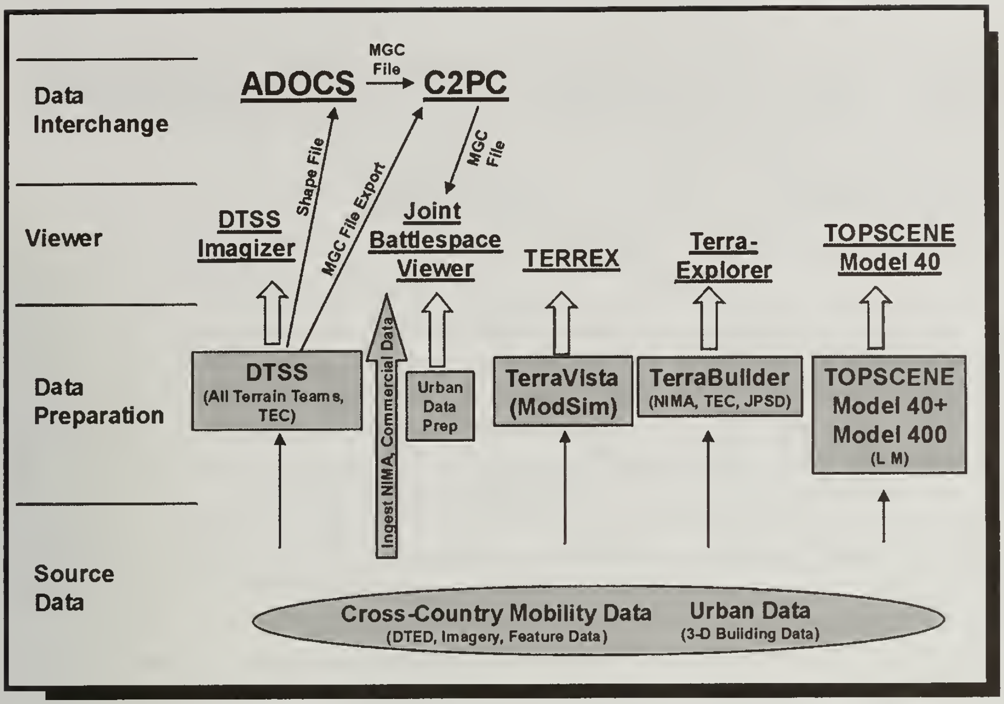

Data Interchange
Viewer
Data Preparation
Source Data
ADOCS
MGC File
C2PC
Shape File
MGC File Export
MGC File
DTSS Imagizer
Joint Battlespace Viewer
TERREX
Terra-Explorer
TOPSCENE Model 40
DTSS (All Terrain Teams, TEC)
Ingest NIMA, Commercial Data
Urban Data Prep
TerraVista (ModSim)
TerraBuilder (NIMA, TEC, JPSD)
TOPSCENE Model 40+ Model 400 (L M)
Cross-Country Mobility Data (DTED, Imagery, Feature Data)
Urban Data (3-D Building Data)

Figure 3. C2PC Terrain Visualization Data Flow

data, or stereo photogrammetry. These are all slow, labor-intensive processes. The only other way to get accurate urban data is to fly a light-detection and ranging sensor over the city to obtain detailed elevation data (1 meter post spacing). Although it is presently not possible to collect urban data using active sensors over denied areas, programs are underway to achieve this capability using unmanned aerial vehicles.

Low-End Software Packages

There are many low-end terrain visualization systems that are free. These systems provide a basic capability to build a 3-D terrain fly-through, but without the impressive visualization capabilities of more powerful high-end systems. TerraBase software, which is trained at the U.S. Army Engineer School at Fort Leonard Wood, Missouri, provides a basic 3-D terrain visualization capability. This GOTS software can be downloaded from the Engineer School Web page (*http://www.wood.army.mil/tvc/DefaultPageContents/MicroDEM_TBII.htm*) for free. TerraBase also provides a variety of other basic geospatial functions. FalconView™ is another free GOTS package that is popular with many users in the field; it is often used in conjunction with C2PC.

High-End Software Packages

More powerful software packages incorporate advanced aspects of terrain visualization. The following systems are currently being used by Army units in the field:

DTSS Imagizer

DTSS software now has the capability to generate the Earth Resources Data Analysis System (ERDAS®) Imagizer file, which can be exported to laptops and PCs as a stand-alone capability. Once the Imagizer 3-D fly-through has been generated on DTSS, it can be disseminated to as many users as needed—for free. Additional tools will be available on the Imagizer file, to include terrain analysis tools, simultaneous 2-D and 3-D displays of detailed data, and the ability to add (ingest) more products. Imagizer will use the Virtual World file generated for the DTSS Virtual Geographic Information System (VGIS®), so terrain analysts are already trained to build data sets. Most PCs can run the Imagizer stand-alone file, but at least a 36-megabyte graphics card is recom-mended. The DTSS is designed to be compatible with systems in the ABCS architecture. Marine Corps teams are also likely to have this software in the near future, since the DTSS and the Marine Corps topographic production capability have the same basic software architecture.

Joint Battlespace Viewer (JBV)

This free GOTS software, developed by the Navy, requires a PC with a 128-megabyte graphics card. It is capable of using multiple resolutions of imagery and digital raster maps. As the user flies closer to the earth, higher-resolution imagery or map products are displayed automatically. The JBV was designed to have good interoperability with C2PC. Army users who need to achieve data interchange with C2PC have shown a high level of interest in the JBV, which can only use Digital Terrain Elevation Data (DTED) Level 1.

TerraVista®

This system is typically associated with modeling and simulation; however, it is relevant to terrain visualization in that it can be used to build detailed urban terrain data for export as a stand-alone file and also for export as source data for other terrain visualization systems. This is the type of data interchange capability that is needed in a world where different systems are being purchased by field units.

TerraExplorer

This system is used to build large terrain databases that can be displayed on most modern PCs. It can display hundreds of miles of data at varying levels of imagery and elevation resolution, with a "seamless" fly-through. It is very simple to install and use. A key benefit of TerraExplorer is that it can be exported to as many users as necessary, limited only by the file size or the number of CD or DVD copiers available. Another aspect that is unique to this system is its capability to support Web-streaming video. This means that the 3-D terrain fly-through can be achieved remotely using a Web browser. The National Imagery and Mapping Agency, the Engineer Research and Development Center-Topographic Engineering Center (ERDC-TEC), and the U.S. Army Joint Precision Strike Demonstration Program Office are using this system to provide terrain visualization capabilities to a wide variety of users.

TOPSCENE

As mentioned at the beginning of this article, TOPSCENE has been used for many years by Army units to achieve high-end terrain visualization capabilities. Costs can be relatively low ($1,000 - $5,000 for each viewer software license) or very high (hundreds of thousands of dollars for the top-level data generation hardware and software). Lockheed Martin Corporation builds the database in a company-proprietary format. Soldiers in the field can update and modify the data by purchasing a midlevel capability to edit the data sets. System capabilities include the infrared and night-vision rendering of a scene and data interchange in a number of formats. The Lockheed Martin data sets built under contract to other Department of Defense users can be obtained for use on TOPSCENE-licensed workstations.

Data Interchange

There is a need for data interchange among the various terrain visualization systems that various units have purchased. The costs associated with building and processing a terrain visualization database can be very high. This is particularly true for generation of detailed 3-D features (such as urban buildings). Contractors and government agencies that build terrain visualization data would serve the needs of the Army best if their data could be used by more of the systems in the field. Limited resources for the production of this data could be conserved by data reuse. If a unit built a terrain database over its immediate area, then adjacent units and higher headquarters could use the same data even if they had different terrain visualization systems.

One of the goals for the Objective Force is to have battle command, modeling and simulation, and mission planning and rehearsal systems—all using the same data. The best way to achieve this is to begin using interchangeable data formats that are commonly accepted. OpenFlight® is one example of a terrain data format for 3-D terrain data interchange in the modeling and simulation community. OpenFlight files can be exported from TerraVista and TOPSCENE. Another interchange format that the modeling and simulation community uses is Synthetic Environment Data Representation and Interchange Specification (SEDRIS™), which contains more detailed terrain information than OpenFlight. TerraVista and TOPSCENE can import and export SEDRIS files. Other commercial standard formats are used to represent imagery, elevation, and feature data. DTSS, TerraVista, and TOPSCENE can import and export data in commercial formats. TerraExplorer and JBV can ingest commercial-format terrain data. The use of common terrain data formats must be increased to achieve data interchange for terrain visualization systems.

Nonstandard System Considerations

When field units purchase nonstandard systems, they enhance their capabilities immediately. However, at least one soldier must start performing tasks that were not established by U.S. Army Training and Doctrine Command (TRADOC) schools through the requirements process. Training and maintenance of the system is a task set that is added as a collateral duty, or the new tasks take the place of tasks that the soldier was performing before. A couple of systems added to the unit can improve operations, but the addition of *many* nonstandard systems can become a problem for individual units and for the Army in terms of training and interoperability and achieving common tactics, techniques, and procedures.

The Army's doctrine, organization, training, materiel, leadership, personnel, and facilities (DOTMLPF) must be adjusted to keep units compatible and interoperable. The TRADOC Program Integration Office for Terrain Data (TPIO-TD) at Fort Leonard Wood, Missouri, is conducting an assessment of terrain visualization systems in conjunction with the ERDC-TEC, the Engineer School, and the TRADOC Battle Command Training Program to address DOTMLPF issues.

Conclusion

Terrain understanding is a fundamental ingredient for success on the battlefield. Soldiers are increasingly using 3-D terrain visualization systems to show the "lay of the land," primarily using elevation data and imagery. The rapid advancement of computer technology and emerging terrain visualization technologies have made it possible for any soldier with a PC to achieve rapid terrain understanding. The Army uses standard systems provided through the acquisition cycle to meet the terrain visualization needs of field users. Field units are also acquiring nonstandard capabilities to augment standard systems and meet their immediate needs. The Army must address DOTMLPF and interoperability issues associated with these emerging capabilities in order to effectively manage the use of standard and nonstandard terrain visualization systems on the same battlefield.

Mr. Bergman, a physical scientist, is a technical representative from ERDC-TEC to TPIO-TD, Fort Leonard Wood, Missouri. A graduate of the U.S. Naval Academy, Mr. Bergman holds a master's in systems engineering from George Mason University. He is also a lieutenant colonel in the Marine Corps Reserve.

Correction: The January-March 2003 issue—which was labeled as Volume 32, PB 5-03-1—should have been Volume 33, PB 5-03-1.

Brigade Returns to USAREUR After 11 Years

By Mr. Arthur McQueen

Note: This article is a reprint from a U.S. Army Europe (USAREUR) News Release from 21 January 2003.

Campbell Barracks, Heidelberg, Germany—The 18th Engineer Brigade (Theater Army) was reactivated 21 January here in a ceremony attended by more than 150 people.

USAREUR Chief of Staff Major General Anthony R. Jones unfurled the colors of the brigade, cased in 1992 at another ceremony just 50 kilometers away in Karlsruhe, Germany.

Jones presented the colors to the new commander, Colonel William H. McCoy, Jr., who also serves as USAREUR's Deputy Chief of Staff, Engineer. McCoy then passed them to Engineer Regimental Command Sergeant Major William D. McDaniel, Jr., for inclusion in the color guard.

McCoy told the attendees the brigade will be at full strength by the end of the year and praised the efforts of the USAREUR staff and others who made the reactivation possible. McCoy challenged his soldiers to be "ready to deploy, tactically and technically proficient." He told USAREUR Commanding General B. B. Bell, "Sir, we are ready."

Specialist Abraham Santana was picked by his first sergeant to be the first soldier to receive and carry the colors. "It's really an honor to carry this flag because of the Army tradition behind it."

The 18th Engineer Brigade, whose motto "Essayons" means "Let us try," has a history dating back to 1921 when it was constituted as the 347th Engineers (General Service) as a reserve unit. It entered active service on 6 May 1942 and entered combat on 29 June 1944, in France.

The brigade was inactivated and reactivated several times prior to July 1965, when it was reactivated and moved to Vietnam. The brigade constructed everything from depots to seaports and airfields to orphanages throughout central and northern Vietnam. It won four meritorious unit commendations and one Republic of Vietnam civil action honor medal, first class, prior to inactivation in 1971.

USAREUR benefited from 15 years of service by the 18th Engineer Brigade, from 1977 to 1992. The brigade provided rail and sea deployment support to the VII Corps and deployed a combat heavy battalion and topographic company to support operations in southwest Asia.

The brigade also coordinated all engineer efforts of a joint and combined engineer force, providing construction and relief support to Kurdish refugees during Operation Provide Comfort. It was last inactivated as part of the reduction of forces in Europe on 15 October 1992.

Mr. McQueen is a public affairs specialist with Headquarters, USAREUR and 7th Army in Germany.

Photo by Arthur McQueen

Colonel William H. McCoy, Jr. (left) passes the just-unfurled colors of the 18th Engineer Brigade (Theater Army) to Engineer Regimental Command Sergeant Major William D. McDaniel, Jr. (right).

FORGING THE ENVIRONMENTAL ETHIC:

TRANSFORMING THE ARMY THROUGH ENVIRONMENTAL STEWARDSHIP

> *"An important part of the Army's Transformation is our continued emphasis on caring for the training lands that sustain and enable Army readiness."*
>
> *—General Eric K. Shinseki*
> *Chief of Staff of the Army*

By Mr. Daniel Taphorn

Most soldiers will agree that the environment is important, but few understand the wide range of issues that make environmental stewardship critical to the military and society at large, particularly in light of Army Transformation initiatives. The ever-increasing need for a collective military environmental consciousness is driven by factors today that directly affect military readiness. It is a combination of these factors and others that helps forge an environmental ethic in soldiers at all levels. For example, knowing the consequences of environmental law violations, understanding the health implications of environmental pollution, and realizing the impact of the environment on military training are just a few of the forces that shape the environmental ethic. Readiness and environmental stewardship are inextricably tied together, and as such, a strong environmental ethic in soldiers will be critical to ensuring that the Army is ready to fight the nation's future wars and win decisively.

Soldiers today are fully engaged, many in the global war on terrorism, and spread out internationally across some 120 countries. Transformation is also increasing the demand on soldiers, requiring them to be smarter, faster-thinking individuals who can operate in extraordinarily complex, asymmetric, and dangerous environments and apply knowledge in increasingly varied and unique situations. In light of these challenges, it is not surprising that soldiers today focus on little more than compliance, to speak nothing of environmental stewardship. One might argue that stewardship of any type must stem from an ethic or set of guiding moral principles or values in order to be truly meaningful. Stewardship thus transcends mere compliance, and it is when environmental protection becomes part of one's system of beliefs that real, meaningful stewardship begins. This paradigm shift in the way soldiers approach the environment will likely be a precondition for Objective Force realization and a key

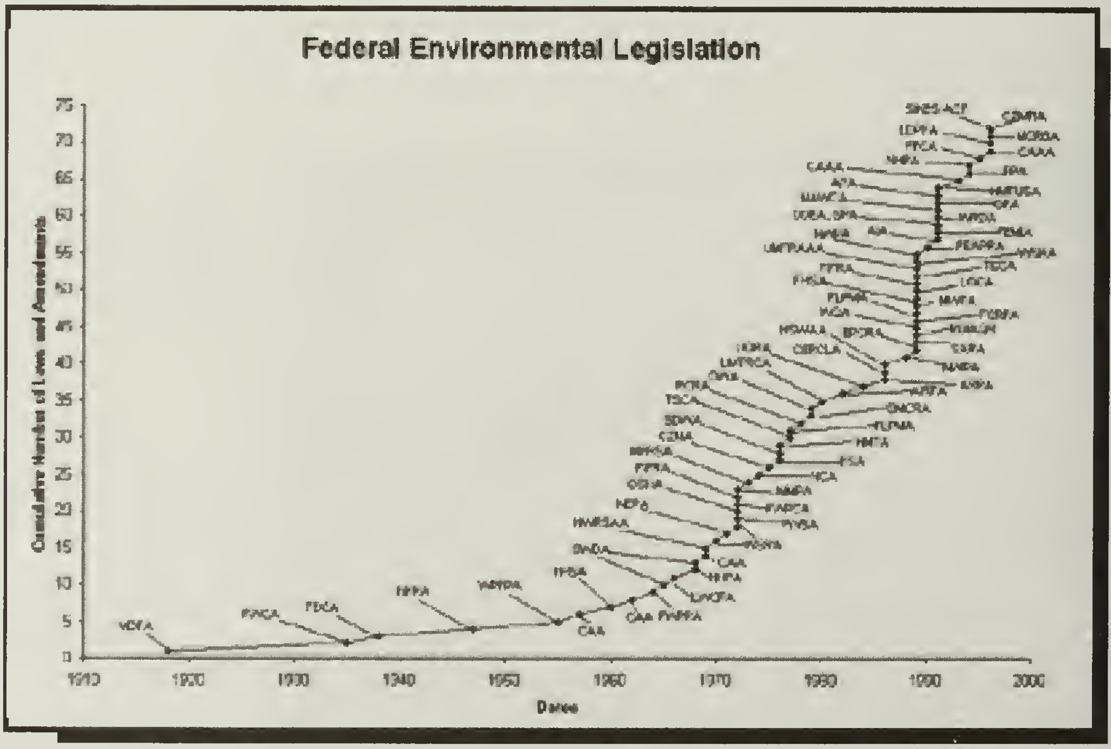
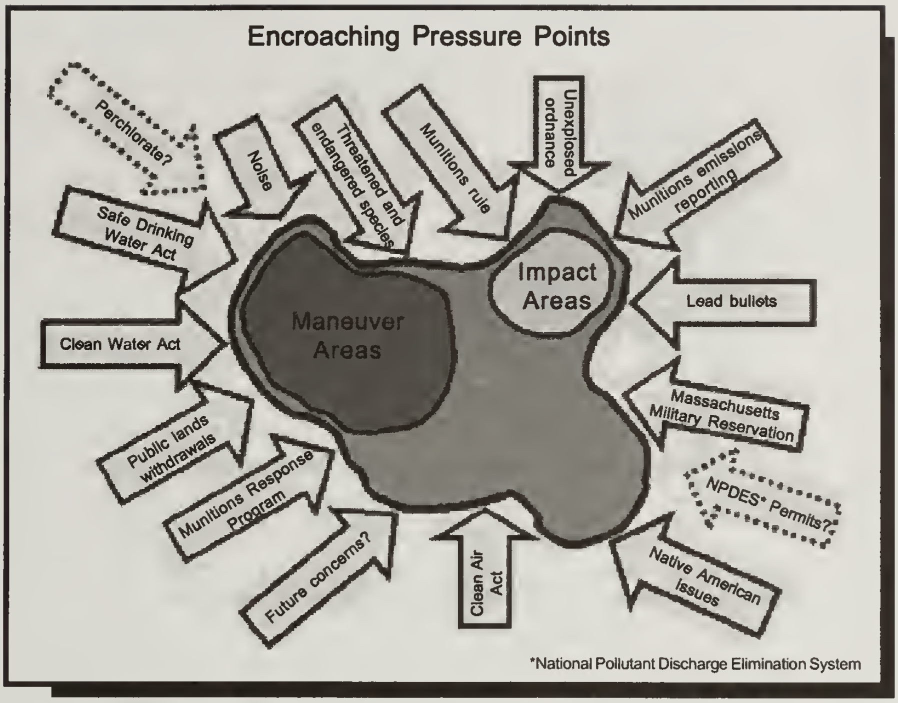


Figure 1



*National Pollutant Discharge Elimination System

Figure 2

component of Army Transformation if the Army is to maintain a strong readiness posture and climate as a values-based institution.

As an evolutionary phenomenon, the development of environmental stewardship is a relatively new occurrence. When put in perspective, the passing of U.S. federal environmental legislation supports this assertion. It has only been in the last few decades that a national environmental consciousness has matured to a point that obliged the passing of what is the majority of environmental federal legislation in existence today. This has resulted in a 400 percent increase in federal environmental legislation passed in the last 33 years over the amount passed in the first 183 years of U.S. history (see Figure 1). To say that the military has been operating under the guise of such legislation since World War I would be a gross fabrication. Even the amount of environmental legislation that existed during the Korean and Vietnam conflicts represents less than a third of the legislation that exists today. Furthermore, it was not until the passing of the Federal Facilities Compliance Act (FFCA) in 1992 that state and local governments could impose fines on Department of Defense (DOD) facilities for noncompliance with environmental laws and regulations. The FFCA also established criminal liability against federal employees who violate federal and state hazardous waste legislation. While the Army has done well to comply with these laws (reducing the number of environmental fines imposed by the federal and state governments over the past several years, going from 58 fines in 1993 to 16 in 2002 and from 307 enforcement actions to 106 over the same period), the impact of growing and existing legislation is hampering military readiness more and more each day. This legislation boom—coupled with other encroachment considerations (the cumulative and aggregate effects from environmental regulation and urbanization that restricts or encroaches on the ability to train on installations)—and Objective Force operational requirements are having a detrimental impact on the conduct of realistic training by creating unacceptable levels of artificiality.

Urban sprawl has contributed to several of the encroachment problems DOD is facing today. During World Wars I and II, military installations were constructed in relative isolation to support the training of a much larger military. Over the last half century, urban sprawl has pushed communities up against installation borders, resulting in an increase in civilian complaints due to live-fire exercises and aircraft noise, smoke, and dust caused by maneuvers. In some cases, installations have self-imposed restricted training hours to pacify disgruntled citizens. Additionally, urban development has continued to eliminate the natural habitats of threatened and endangered species surrounding installations. As a result, these species are forced onto installations, turning these training areas into "islands of biodiversity," which generate further training restrictions for units. Consequently, there are more than 150 endangered species residing among 94 U.S. Army installations today. Figure 2 portrays this and several other environmental variables that contribute to the degradation of a unit's ability to train.

Urban sprawl is affecting installations in other ways. Natural resources are being consumed at a rate that stresses installation capacities. For example, Fort Bragg, North Carolina, has experienced water shortages from the increasing consumption of the growing, upstream Raleigh-Durham community. Additionally, the industry and population growth in North Carolina has resulted in more stringent air quality requirements. Regional shortfalls in complying with Clean Air Act (CAA) standards may further restrict training, construction activities, and transportation.

Objective Force operational requirements are also exacerbating the situation. Doctrinal distances for operating maneuver units are expanding from about 96 square kilometers (km^2) during World War II to an operating area of about 2,500 km^2 for the Stryker Brigade Combat Teams (SBCTs). Consequently, the Army today is faced with the dilemma of exploring ways to sustain the Objective Force, with its known and still developing doctrinal requirements, in an increasingly restrictive training environment. The situation at Fort Hood, Texas, illustrates the encroachment problem. Of the some 185,000 acres of training land, only 16 percent (or roughly 30,000 acres) is restriction-free throughout the year. The white areas on the Fort Hood map in Figure 3, page 40, represent training areas without encroachment-related restrictions. The

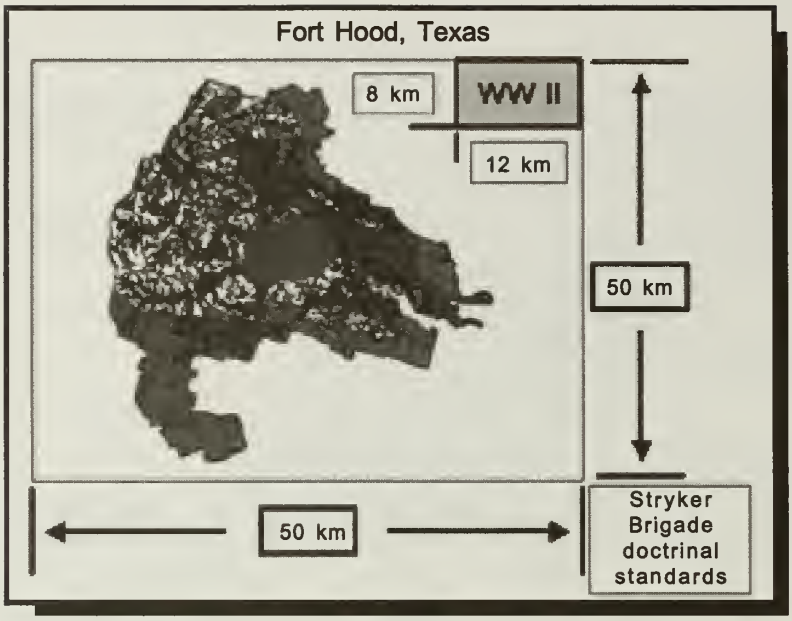


Figure 3

figure also depicts the doctrinal change in operating areas from the U.S. Army of World War II (96 km^2) to the new requirements of the SBCT (2,500 km^2).

The concept that addresses environmental issues and others is *sustainability*. Not to be confused with the operational term *sustainment* as defined in Field Manual (FM) 3-0, *Operations*, or Joint Publication (JP) 1-02, *Department of Defense Dictionary of Military and Associated Terms*, sustainability (or sustainment) in the context of transformation is a comprehensive approach that brings all Army resources to bear on achieving readiness. As such, initiatives like the Sustainable Range Program and Installation Sustainability Program are at the forefront of Army efforts. Transformation of Installation Management (TIM) realigns installations into seven regional directorates as part of the Installation Management Agency under the Office of the Assistant Chief of Staff for Installation Management. TIM creates a more efficient, businesslike structure and supports these sustainability initiatives. In short, sustainability is about—

- Creating efficiencies that reduce waste.
- Reducing dependence on nonrenewable resources.
- Enhancing productivity.
- Lowering system life cycle costs.
- Decreasing the environmental impacts on training and the potential for fines.
- Creating mutually beneficial relationships with local communities.
- Enhancing the well-being of soldiers and civilians.
- Optimizing the ability to conduct realistic training in support of readiness.

Achieving these objectives will be an arduous task—one that lends greater credence to the importance of an Armywide environmental ethic.

To promote the environmental ethic in support of Army Transformation, in 2000, the Vice Chief of Staff of the Army designated the U.S. Army Engineer School as the proponent for integrating environmental consideration across doctrine, organization, training, materiel, leadership, personnel, and facilities (DOTMLPF) and into military operations. On behalf of the Engineer School, the Directorate of Environmental Integration (DEI) has since developed several training products (such as resident courses and distance learning products like Army Correspondence Course Programs and Graphic Training Aids) and doctrinal publications such as FM 3-100.4, *Environmental Considerations in Military Operations*. Additionally, DEI incorporates pollution prevention initiatives into the materiel requirements determination and development process to maximize efficiency and minimize pollution throughout a system's life cycle. This represents some of the DEI initiatives that promote Army environmental stewardship in direct support of Army sustainability initiatives.

An event that will soon be a benchmark of the Army's environmental stewardship posture is the implementation of an environmental management system (EMS). Required by Executive Order 13148, each federal agency will be required to implement an EMS at all appropriate facilities by 31 December 2005. EMS (as defined by International Organization for Standardization [ISO] 14001) is "the part of an overall management system that includes organizational structure, planning activities, responsibilities, practices, procedures, processes, and resources for developing, implementing, achieving, reviewing, and maintaining environmental policy." ISO 14001 does not define absolute requirements for environmental performance. Instead, it requires a commitment by the organization to continuous improvement. Since the goal is for improved environmental performance, the ISO 14001 methodology involves integrating effective management mechanisms into the management structure of the organization. There are five essential and auditable elements of an ISO 14001-compliant EMS. They include environmental policy, planning, implementation and operation, checking and corrective action, and management review.

The benefits of the Army's EMS directly support many activities on sustainable installations, and the areas that EMS has the potential to positively affect are abundant. The EMS will improve the forecasting ability of installation leadership in identifying environmental issues, allowing leadership to take proactive steps toward addressing these issues rather than reacting to them. It will facilitate Army Transformation by protecting training and maneuver areas. The EMS will also enhance the well-being of Army soldiers, civilians, and families through more robust management of environmental health issues. It will facilitate compliance with the law and will help foster a climate of environmental stewardship. For example, in a post-September 11 world, the EMS will facilitate faster, more prepared responses to environmental modification threats on sensitive U.S. targets (such as attacks on power plants, wastewater treatment plants, and industrial sites) through sound consequence management and planning as part of the global war on terrorism. As part of sustainable installations, the EMS will also contribute to cost savings by reducing waste and mitigating the risks that result in environmental fines. Undoubtedly, the EMS will play a vital role in the management of environmental issues during future base realignments and closures. By providing these benefits and others, the EMS will support unit training and readiness for decades to come. However, since an effective EMS feeds into the installation management structure, it will be soldiers and civilians at all levels who will feel the effects of the EMS and ultimately determine its success or failure.

While critical to readiness, environmental considerations do not cease to be important when units deploy on missions away from installation boundaries. Although installation environmental issues may seem administrative in nature, integrating federal, state, and local environmental restrictions into the military decision-making process while training directly supports real-world contingency planning across the spectrum of military operations. FM 3-100.4 is the U.S. Army and Marine Corps guide in applying appropriate environmental protection procedures during all types of operations. In it, an excerpt from Joint Vision 2010 states—

> *"The American people will continue to expect us to win in any engagement, but they will also expect us to be more efficient in protecting lives and resources while accomplishing the mission successfully. Commanders at all levels will be expected to reduce the costs and adverse effects of military operations, from environmental disruption in training to collateral damage in combat."*

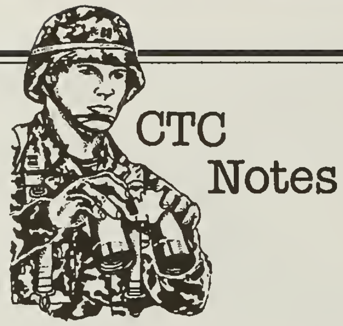
Increasingly, environmental considerations are playing a larger role in preserving mission legitimacy. A lessons learned publication for judge advocates, titled *Law and Military Operations in the Balkans, 1995-1998*, states that "Task Force Eagle noted that environmental considerations in peace operations are enormous because preserving the mission's legitimacy is as critical as combat readiness to overall success."

This bold premise, while sometimes disconcerting to warfighters, is often a defining characteristic of military operations other than war. Consequently, integrating environmental considerations across the spectrum of military operations, both vertically and horizontally, is critical to managing risk on today's asymmetric battlefield.

DOD and the Army have embraced environmental protection as both a necessary and an ethical responsibility to achieve sustainability and readiness. Environmental stewardship directly supports the Army Vision by protecting the natural resources that contribute to the health and welfare of our soldiers, families, and surrounding communities (people); providing forces with the land and resources necessary to conduct realistic training with minimal constraints (readiness); and transforming business processes through the implementation of an Army EMS. The EMS is a key component of sustainable installations and forging an environmental ethic in soldiers and civilians at all levels through the integration of environmental considerations across DOTMLPF (transformation). FM 3-100.4 affirms that "from every philosophical or moral perspective, environmental stewardship is the right thing to do." Department of the Army soldiers and civilians must support this cause, not solely based on the legal requirement to do so but because it is "the right thing to do." Understanding this moral imperative will foster the development of an environmental ethic and promote meaningful environmental stewardship.

Of the many uncertainties lingering in the future, one thing is clear: Environmental stewardship is and will continue to be part of the way the Army does business. Stewardship does not exist separate from the Army values of loyalty, duty, respect, selfless service, honor, integrity, and personal courage; rather, it is unequivocally bonded to each of them. Stewardship founded on a solid environmental ethic is an evolutionary process with the potential to reap huge benefits for installations and their surrounding communities. As institutional knowledge of the environment continues its accelerated growth, environmental considerations will play an increasingly important role throughout peace and conflict. It is the environmental ethic that facilitates the EMS. It is the EMS that supports sustainable installations. It is the sustainable installation that enables Army Transformation, and it is transformation—among other things—that will enhance readiness. While viewing these items linearly is helpful, it only partially represents what is an otherwise intertwined and difficult process. Environmental stewardship provides many benefits that extend beyond installation boundaries. Community goodwill and the enhanced prestige as the nation's defender are also benefits of military environmental stewardship. However, achieving sound environmental stewardship requires strong environmental leadership. As FM 22-100, *Army Leadership*, puts it, "Doing the right thing is good. Doing the right thing for the right reason and with the right intention is better." This will be the yardstick against which the Army and its soldiers will be measured, as the Army enhances combat readiness through early consideration and resolution of environmental impacts and transforms into the Objective Force.

Mr. Taphorn, a training analyst with Horne Engineering Services, Inc., works in the Training Division, Directorate of Environmental Integration, U.S. Army Engineer School, Fort Leonard Wood, Missouri. A former Army engineer captain, his assignments included S3, 554th Engineer Battalion, and platoon trainer, B/554th Engineer Battalion, Fort Leonard Wood, Missouri; and executive officer, HHT/2-17 Cavalry Regiment, and platoon leader, C/326th Engineer Battalion, Fort Campbell, Kentucky.



National Training Center (NTC)

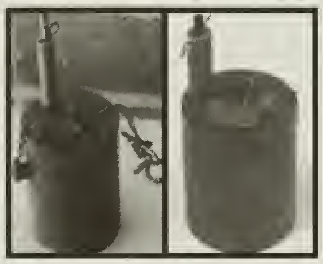
Conventional Threat Antipersonnel (AP) Mines (OZM-3)

By Master Sergeant Mark A. Sankey

As NTC continues to implement the contemporary operational environment (COE), the Opposing Force (OPFOR) will also adjust its inventory of battlefield effects to match worldwide threats and challenge the rotational units. The OZM-3 marks the arrival of the AP mine to NTC. Units should realize that AP mines are a realistic threat and will be replicated during their rotations. Units do not train on or emplace AP mines but must react to their presence on the battlefield.

Capabilities

The OZM-3 can be detonated with a variety offuses, including trip wires and electrical command. The mine weighs 3.0 kilograms and has a cylindrical cast-iron body that is sent into the air by a small charge at the base of the mine. Triggered by a delayed charge, the body of the mine explodes approximately 1.5 meters off the ground. The fragmentation results in a casualty radius of 25 meters. Because of its metal content, the OZM-3 can be readily detected by demining/detection equipment.


Actual (L) and training aid (R) OZM-3s

OZM-3 Characteristics	
Height	120 millimeters
Diameter	75 millimeters
Mine weight	3 kilograms
Explosive weight	75 grams TNT
Casing material and color	Olive-green cast-iron body
Fuse type	Mechanized utility vehicle (MUV) series,VPF, RO-1, RO-8, and electrical and seismic firing systems NM, MVE-72, and VP-4/12/13)
Sensitivity	As for each fuse
Detectability	Yes

Rules of Engagement (ROE)

There are no ROE changes to explosive- and mechanical-reduction techniques. For manual reduction, proper grappling techniques (according to FM 20-32, *Mine/Countermine Operations*) will result in the AP mines being detonated without casualties. Failure to adhere to this procedure will result in casualty assessment of the grappler. If a grappling hook hits a mine, the mine will be assessed as destroyed along with the grappling hook and a small portion of the grappling hook line. The assessment of the line will be based on the materiel type and how the line is laid near the mine.

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Engineer Support Area (ESA) Live Fire

By Major Gerald O'Connor and Captain Thomas D. Patton

For several years, the brigade support area (BSA) has conducted a defensive training event during the live-fire rotation. Other separate support elements have also had live-fire training events. Though these events have always been important, the asymmetrical threat posed by the COE has demonstrated the necessity of all elements. Throughout the depth of the brigade's area of operations, it is necessary to maintain a high level of protection. Starting this year, Force XXI unit ESAs and units with separate unit maintenance collection points can also take part in a live-fire defensive training scenario.

When reacting to a mounted and dismounted threat within the brigade rear boundary, units must defend their perimeter from a combination of light armored vehicles, dismounted soldiers, and aerial attacks. Units are required to analyze intelligence reports from higher headquarters, raise their readiness posture, and defend their perimeter from prepared fighting positions using individual and crew-served weapons, sector sketches, and fire control measures. As units defend their perimeter, they must evacuate casualties and conduct ammunition redistribution and resupply. This scenario gives soldiers greater confidence in their weapons proficiency and an ability to defend themselves from an attack.

Units wishing to take part in this training must meet the following requirements:

- They must request the ESA live fire in their 180-day letter to the NTC.
- Firing soldiers must have qualified on assigned weapons within 180 days of the live-fire event.
- They must complete the Dragon Team live-fire safety brief.
- Soldiers must be in flak vests and proper field uniforms.
- M2s must be screened according to the ROE, Chapter 3.
- They must complete a minimum of hasty fighting positions to standard for the firing soldiers.
- Fighting positions must have aiming stakes with methods to limit elevated fires over 45 degrees.

This event also requires resources from the brigade rotational ammunition allocation that is equivalent to the amount of Class V supplies currently used by engineers involved in the BSA live fire.

Suggested Ammunition Allocation

Department of Defense Identification Code (DODIC)	Nomenclature	Weapon	Number of Rounds
A557	.50-caliber 4:1 (M2)	M2, .50-caliber	300 rounds per M2
A059 or A064	5.56-millimeter ball 5.56-millimeter 4:1	M16	40 rounds per firing soldier
A062	5.56 4:1 squad automatic weapon (SAW)	SAW	200 rounds per SAW
A131	7.62-millimeter 4:1	240B	200 rounds per 240B

Units should coordinate for the ESA live fire with the Sidewinder Team at Fort Irwin during the leadership training program or in the brigade 180-day letter.

The ESA live fire gives rotational units a tremendous opportunity to focus on total unit protection and provide their soldiers realistic live-fire training.

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Wet-Gap Crossing

By Major Michael W. Rose and Captain James Koeppen

NTC has developed a river-crossing scenario for rotational units. Blue Force (BLUFOR) units may be required to conduct a river-crossing operation in order to deploy into its area of operations. In the scenario, the "Calusan Canal" is the main water source for "Irwin Military City," making it an environmentally and politically sensitive site. The canal is narrow enough to cross with an armored vehicle-launched bridge (AVLB), but in certain areas the water velocity exceeds vehicle-fording capabilities. Vehicles that enter the canal will be assessed as a mobility kill and will require recovery assets. After the brigade crosses the canal, it may request division assets to come forward and establish permanent crossing sites.

So that the scenario does not fall under the category of a true deliberate river crossing, units have at least three options when planning for the mission:

- Use the crossing fundamentals as outlined in FM 90-13, *River-Crossing Operations.*
- Use the breaching tenets covered in FM 3.34.2, *Combined-Arms Breaching Operations.*
- Use a combination of doctrine covered for both river-crossing and breaching operations.

Regardless of the technique used, there are four critical aspects that must be fully developed during the planning process:

Command and Control (C2)

Units must fully develop effective C2 to ensure a deliberate and coordinated effort in establishing river-crossing sites as well as managing traffic control and flow. One technique used recently was to have AVLB commanders report directly to platoon leaders, who acted as crossing site commanders at the call-forward area to control throughput from the call-forward area to the crossing sites.

Traffic Control

Detailed planning for traffic control must include routes used by separate task forces from the release line to holding areas, call-forward areas, and crossing sites. Integration of military police platoons is vital to marking routes and establishing and manning traffic control points. Ultimately, the goal is to enable the brigade combat team to rapidly reroute units if one or more crossing site becomes unavailable.

Communication

A solid communication plan will bring together the C2, traffic control, and throughput of the brigade across the canal. Although this list is not all-inclusive, you should ask yourself the following questions during the planning process:

- Who is controlling traffic from the release line to the staging areas and on what net?
- What net are the traffic control points operating on and to whom are they reporting?
- What nets are the crossing sites and call-forward areas operating on and to whom do they report?
- Who is tracking traffic flow at the task force and brigade combat team levels?

Risk Management

Most brigade combat teams have not crossed an entire team across AVLBs. This makes it essential to conduct proper risk management at all levels. Using AVLBs during rehearsals in the rotational unit bivouac area (RUBA) is one mitigation technique. Inspecting and configuring equipment at the call-forward area, as well as briefing vehicle crews on AVLB crossing procedures, is also a way to mitigate risk during the operation.

Summary

The canal-crossing scenario at NTC provides units an opportunity to plan and execute a realistic gap-crossing operation and develop tactics, techniques, and procedures addressing critical issues that are likely to be encountered in real-world contingencies.

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Joint Readiness Training Center (JRTC)

Engineer Participation in the Targeting Process

By Captain Mark C. Quander

Today, we face a more asymmetric threat than in the past. The enemy does not look like a conventional force and has become more unpredictable and more lethal. As we adapt, commanders at all levels will have greater challenges in focusing combat power effectively against these forces. Failure to do so can be perilous. However, a process already exists to assist the commanders and staff in focusing combat power to win decisively—the targeting meeting. A successful targeting meeting requires active participation from all members of the Battlefield Operating System. The following paragraphs describe how engineers take an active role in targeting:

Why Targeting?

FM 6-20-10, *Tactics, Techniques, and Procedures for the Targeting Process*, states—

> *"The targeting process supports the commander's decisions. It helps the targeting team decide which targets must be acquired and attacked. It helps in the decision of which attack option to use to engage the targets. Options can be lethal or nonlethal and/or organic or supporting. For example, they can be maneuver, electronic attack, psychological operations (PSYOP), attack helicopters, surface-to-surface fires, or a combination of these. In addition, the process helps in the decision of who will engage the target at the prescribed time. It also helps targeting teams determine requirements for combat assessment to assess targeting and attack effectiveness."*

Targeting Methodology

The targeting process is formed from the model of *decide*, *detect*, *deliver*, and *assess* (D3A). The targeting methodology can be used to describe how engineers can provide input into the process. In *deciding* which targets to attack, engineers must provide input to develop the high-payoff target list (HPTL). A high-payoff target (HPT) is something that friendly forces perceive to be necessary for enemy forces to accomplish their mission. Some HPTs that engineers could recommend are enemy scatterable munition systems, tactical minefields, and enemy breaching assets. However, you must be specific. Usually, not all HPTs will be targeted because the unit may not have assets available to target them all. If you want to target enemy breaching assets, list the type of breaching asset you want targeted (such as the KMT-4). If you want minefields listed as HPTs, then nominate the ones that will affect future operations (such as minefield B01). The templated minefields will be used to continue describing the process. See Figure 1 for examples of assets that can be used during various stages of the targeting process.

To *detect*, nominate the templated minefields that impact future operations as named areas of interest (NAIs). NAIs are used to help confirm or deny a particular enemy course of action. During the targeting meeting, the D3A model is captured on the target synchronization matrix (TSM) (see Figure 2). The templated minefield located at WQ01654015 on the TSM will be used to describe the process. The staff recommended this minefield as NAI 43 on the TSM. If practical, have multiple assets (primary and alternate) target the NAI at various times. Ensure that the collectors have time windows in which to collect on the NAI, because you don't want all the collectors at the NAI at the same time. Also, the assets you are targeting must report back in a timely fashion. Give them a time for the latest time of intelligence value (LTOIV). Be cognizant of the other minefields, but the targeting process should focus on what has a bearing on future operations. In this instance, the unit has chosen to use OH-58D scout reconnaissance helicopters as the primary detector and B/1-187 Infantry as the secondary collector on the NAI. Again, the detection windows must be at different times. If the NAI is denied, then the assets to *deliver* or *assess* are free for other missions.

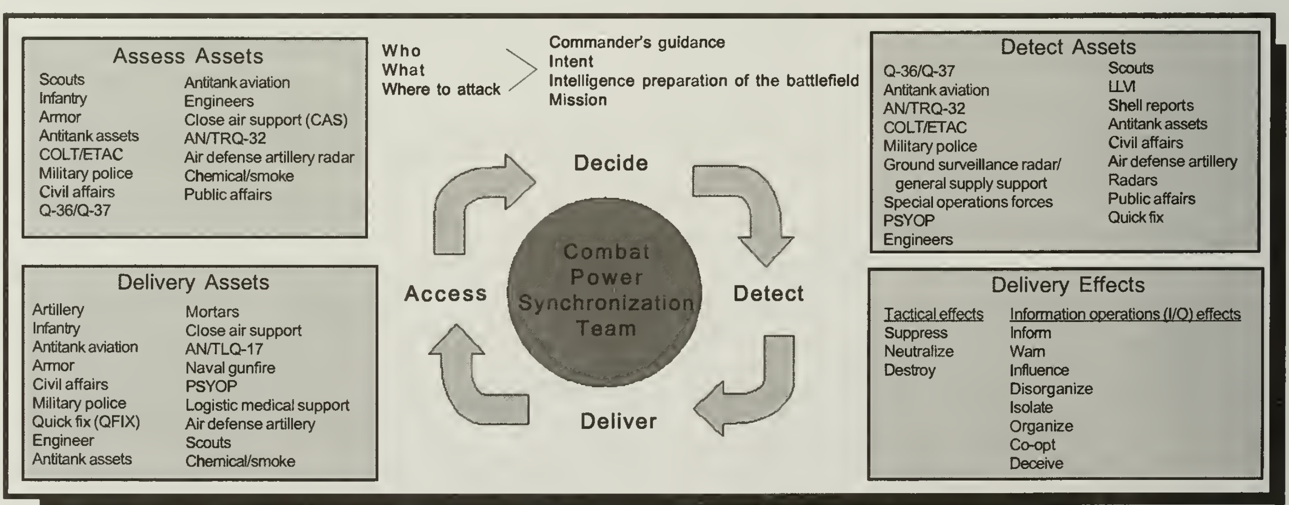

Figure 1. Targeting the Rakkasan Way (Based on a figure in CALL Newsletter No. 02-3 Feb 02)

Target Synchronization Matrix (Phase/Event: III – Expand the Lodgement)
H-Hour is 052200MAR03

As of:
031200ZMAR03 to
041159ZMAR03

Decide			Detect		Deliver		Assess	
HPT	Location	NAI	Agency	Assets	Agency	Assets	Agency	Assets
DShK	WQ02404210	1	Division	LRS	Division	NGF/CAS	Division B/311 MI Bn	LRS QFIX
			B/311 MI Bn	QFIX	3-320 FA	105 mm		
			B/311 MI Bn	QFIX	3-320 FA	105 mm		
SA-18	WQ00654372	6	Division	LRS	Division	NGF/CAS/ J-SEAD	B/311 MI Bn	QFIX
			B/311 MI Bn	QFIX	3-320 FA	105/155 mm		
Minefield	WQ01654015	43	2-17 Cav Rgt	OH-58D	Team Heavy	MICLIC	Team Heavy	Mine roller
						Mine plow		
			B/1-187 Inf Rgt	Mine detectors	Team Clear	Explosive		
					C/326 Engr Bn			
	WQ01563567	23	2-17 Cav Rgt	OH-58D	Team Heavy	MICLIC	Team Heavy	Mine roller
						Mine plow		
					Team Clear	Explosive		
			C/1-187 Inf Rgt	Mine detectors	C/326 Engr Bn			

Legend:

DShK = [12.7mm Krupnocalibernyj Pulemet Degtyareva-Shpagina, DShK] A heavy machine gun used as an antiaircraft weapon and also as a heavy infantry support gun.

JSEAD = joint suppression of enemy air defense

LRS = long-range surveillance

NGF = Naval gun fire

SA-18 = A Russian manportable surface-to-air missile

Figure 2

If the NAI is confirmed, the *deliver* assets committed will bring effects against the target.

Deliver against the target by destroying, neutralizing, or suppressing it. In this case, we would neutralize the minefield by breaching a lane or by clearing. In choosing the deliver asset, don't just think about what assets engineers bring to the fight, but rather what assets the unit brings to the fight—plows, rollers, mine-clearing line charges (MICLICs), Antipersonnel Obstacle-Breaching Systems (APOBs) (for AP minefields and wire), etc. For NAI 43, the staff used Team Heavy, the armor company team, as the primary unit to *deliver* effects against the minefield with primary means of the MICLIC, then the plow. It is a planned operation, so the unit should have time to prepare and rehearse before execution.

The final part—*assess*—can be done again by engineers or any number of assets to report battle damage. In this case, the minefield was proofed by Team Heavy. The unit used a roller to assess the minefield and ensure that no mines were present in the area they breached or cleared. However, battle damage is usually very difficult to assess. When a unit thinks about preassault fires on an objective to attrit enemy forces before an attack, how do we confirm that the forces have been attrited sufficiently? *Assess* is generally the hardest part of the process. At the completion of the targeting meeting, the information from the TSM will be used to build a fragmentary order (FRAGO). Brigade-level targeting should focus future operations 48 to 72 hours out and battalion-level operations 24 to 48 hours out.

Preparing for the Targeting Meeting

The same level of detail that goes into preparing for the military decision-making process (MDMP) should be applied to the targeting meeting. Targeting should be built into the MDMP timeline as well as a unit's battle rhythm. Generally, products used in the targeting meeting are refinements to already-existing products. As part of course-of-action analysis and comparison, the staff generally starts the targeting process with a targeting conference. Using the results of staff wargaming and intelligence preparation of the battlefield (IPB) as a guide, the planning staff focuses assets to assist with the collection process. Engineers should do the following before the targeting meeting begins:

- Update the assets-available list.
- Refine the obstacle template (from initial entry).
- Prepare the obstacle-tracker overlay.
- Collaborate with the S2 to ensure that enemy engineers are portrayed on the situation and event templates.

During the Targeting Meeting

During the targeting meeting, the engineer should consult with other staff officers. Engineers must talk in maneuver terms in order to get mobility/survivability/countermobility targets that support the commander's plan serviced. During the targeting meeting, the following coordination should take place:

With the S2:

- Confirm the template.
- Perform predictive analysis—nominate NAIs.
- Assist in developing the situation and event templates with probable enemy employment of engineer assets and obstacle emplacements.
- Describe the effects of terrain and weather on maneuvers.
- Participate in the selection of decision points, NAIs, and targeted areas of interest (TAIs) for obstacles.
- Identify enemy engineers supporting the reconnaissance effort.
- Confirm HPT (bridging assets, breaching assets, and scatterable mine delivery systems).

With the S3:

- Assist in developing the high-value target list (HVTL) and nominating high-value targets (HVTs) to the HPTL.
- Advise on the employment of scatterable munitions to attach targets and the selection of TAIs to support the employment.
- Review the minefield report.
- Prioritize the clearance of routes.
- Draft tasks to subordinate units.
- Recommend task organization changes.

With the S4:

- Synchronize the logistics package resupply with the brigade combat team route clearance package.

With the medical officer:

- Synchronize the route clearance package with casualty evacuation routes.

Conclusion

The targeting process enables the staff to direct all the elements of combat power against enemy forces to win decisively. Conducted daily, the targeting meeting should provide subordinate units sufficient time to prepare for future operations. The end product of targeting should be an updated TSM, reconnaissance and surveillance plan, HPTL, and FRAGO with appropriate task organization changes. Engineer participation in targeting is critical and, in doing so, they ensure that engineers are out front, providing the commander mobility on the ground.

CPT Quander is a light engineer platoon senior observer/controller. Previous assignments include commander, C/326th Engineer Battalion (Air Assault), Fort Campbell, Kentucky—deploying to Afghanistan in support of Operation Enduring Freedom; platoon leader, A/307th Engineer Battalion (Airborne), Fort Bragg, North Carolina; and assistant brigade engineer, 1st Brigade, 82d Airborne Division, Fort Bragg, North Carolina.

Combat Maneuver Training Center (CMTC)

Synchronizing the Brigade Combat Team Breach—"SOSRA in Effect"

By Major John Horstmann and Sergeant First Class Danny Petersen

> *"Obstacle breaching is the employment of a combination of tactics and techniques to project combat power to the far side of an obstacle. Breaching is a synchronized combined-arms operation under the control of a maneuver commander."*
>
> —FM 3-90.3, *The Mounted Brigade Combat Team*

All too often, maneuver forces come to a stalemate at the breach, leading to mission failure immediately thereafter. CMTC discovered that one of the causes of this is the failure to synchronize the breach during brigade combat team (BCT) planning and rehearsals. Typically, units happen into breaching operations before doctrinal conditions are set. Although FM 3-34.2, *Combined-Arms Breaching Operations*, serves as the capstone breaching manual, many maneuver commanders focus primarily on FM 3-90.3. It discusses combined arms breaching operations in Chapter 12, where Table 12-4 (see Table 1 below) provides a basic framework. However, it does not specify who has direct responsibilities for each decision or event. As a result, these decisions are routinely delegated to very low levels within the BCT.

Decisions	Criteria
Decide the point of penetration and reduction site.	- Reconnaissance force identifies obstacles and enemy positions related to priority intelligence requirements (PIR).
Commence suppression and obscuration fires.	- Observers are in position. - Support force crosses designated phase line (PL).
Occupy support-by-fire (SBF) position (support force).	- Critical friendly zone (CFZ) is in place over the positions. - Obscuration is in place to screen support force movement. - Designated essential fire support tasks (EFSTs) are completed. - Support force maintains more than 70 percent of its combat power.
Commit the breach force.	- Suppression and obscuration is adjusted and effective. - CFZ is in place over reduction site. - Engineer preparations are completed. - Fire control measures are in effect.
Commit the assault force.	- Lane is created, proofed, and marked. - Far-side security is in position.

Table 1. Establishing criteria (Based on Table 12-4 from FM 3-90.3)

Fundamental to achieving synchronization are detailed reverse-breach planning, clear subunit instructions, well-rehearsed forces, and effective command and control. Without proper breach synchronization, the conditions for executing the breach will not be established when necessary, generally resulting in the rapid destruction of breaching assets.

The assistant brigade engineer (ABE), as the staff officer primarily responsible for setting the plans groundwork, has many tools available to assist him during the planning process. FM 3-34.2, Chapter 1, paragraph 1-44, provides a detailed explanation of how to synchronize breaching planning and operations. Table 2, (which is Table 1-2 in FM 3-34.2) is a breaching complexity chart, which shows successful synchronization of breaching operations and provides an example of the complexity of the operation. It is also a good tool to use as a template during planning or rehearsing or when explaining the complexity of breaching operations to maneuver brethren. This same chart is also a template to effectively build an execution matrix of the breaching operation. This chart, like Table 12-4 from FM 3-90.3, does not designate responsibility for decision making.

A good relationship between the ABE and other BCT planners, especially the fire support and chemical officers, enables the ABE to create a framework for the breach that best fits the brigade commander's intent. Using the reverse-breach planning process, the ABE must ensure that the commander's intent—as it relates to mobility, countermobility, and survivability operations—is understood. The ABE also recommends changes to support that intent, based on the capabilities and limitations of engineer assets under brigade control. But more importantly, the ABE must convey to the brigade staff the conditions that must be set before attempting the breach in order to synchronize these conditions throughout planning and war gaming. If the reverse-breach planning process is followed, and the staff members have synchronized their efforts, the stage is set for a fluid breach at the combined-arms rehearsal (CAR) and in combat.

Far too often the breach force commander commits assets only to have them killed by direct and indirect fires as they reach the obstacle. As engineers, we must communicate to the brigade commander that the conditions must be set before moving breaching assets forward to the obstacle. Disaster awaits if units attempt to breach before setting these basic conditions. This level of synchronization begins with the planning process, is reinforced at the CAR, and continues through the beginning of operations. At the CAR, all too often the term "SOSRA [suppress, obscure, secure, reduce, assault] in effect" is heard from senior leaders when addressing breaching operations, and the rehearsal continues with the assault force conveniently placed on the other side of the breach. Such a simple wave of the hand does not work on the battlefield. Leaders need to demand specifics during the rehearsal, with each step addressed individually. Following is an example of such a rehearsal:

- *Suppress*. Who is suppressing? With what systems and ammunition? Who is being suppressed and where?
- *Obscure*. Who is obscuring and for how long? With what system and ammunition? Who is the obscuration being directed against and where? What is the required duration of the obscuration? Who determines whether the

Actions	Element	Time (Minutes)	Controlled By
Develop the situation (verify the boundary of the enemy obstacle system).	Force in contact	M to 2	S3
Maneuver the support force into the overwatch position.	Support	M + 2 to 15	Support commander
Maneuver the assault force into the covered assault position.	Assault	M + 2 to 15	Assault commander
Call for artillery.	Direct support (DS) artillery	M + 2 to 15	Fire support officer (FSO)
Build smoke.	Mortars	M + 5 to 10	FSO
Suppress the enemy with direct fires.	Support	M + 15 to 29	Support commander
Suppress the enemy with artillery fires.	DS artillery	M + 10 to 29	FSO
Maintain smoke.	DS artillery mortars	M + 10 to 30	FSO
Maneuver the breach force to the breach location.	Breach	M + 20 to23	Reduction commander
Reduce the obstacle and prepare two lanes.	Breach	M + 23 to 30	Engineer leader
Place smoke pots.	Breach	M + 23 to EOM	Reduction commander
Shift direct fires off the objective.	Support	M + 29 to 30	Assault commander
Shift indirect fires beyond the objective.	DS artillery	M + 29 to 30	Assault commander
Assault to destroy the enemy on the far-side of the obstacle.	Assault	M + 30 to 45	Assault commander
Reorganize to continue the mission.	Task force	M + 45 to EOM	S3
NOTE: M = Contact with the obstacle			

Table 2. Breaching complexity (Table 1-2 from FM 3-34.2)

Breach Fundamental	Decision	Criteria	Decision Maker
Suppress	Initiate suppression	- Position of support force - Reconnaissance of enemy position	Support force commander
	Shift suppressive fires	- Position of breach and assault forces	Support force commander
Obscure	Initiate obscuration	- Position of breach, support, and assault forces - Observers in position	Task force commander
	Adjust obscuration	- Wind direction - Terrain - Ammunition remaining	Breach force commander
Secure	Initiate near-side security	- Position of security force - Templated position of overwatching force	Task force commander
	Initiate CFZ/ADA coverage	- Position of breach force	Task force commander
Reduce	Determine breach area	- Engineer battlefield assessment (EBA) and intelligence preparation of the battlefield (IPB) - Forces available - Reconnaissance results	Brigade commander
	Initiate breach	- Successful obscuration - Successful suppression - Nearside security established - Position of breach force	Breach force commander
	Breach lane complete	- Position of breach force - Initial marking complete	Breach force commander
Assault	Initiate assault force	- Position of breach force - Far-side security established - Lane marking complete	Breach force commander
	Shift fires	- Position of breach, suppression, and assault forces	Assault force commander

Table 3. Assigning responsibility for key decisions

obscuration is successful or not? Who is the primary/secondary observer?

- *Secure*. Who is securing and where? And with what systems? What fire control measures are in effect? What air defense artillery (ADA) coverage is there, and who provides it? Where is the CFZ, and who controls its initiation and termination?
- *Reduce*. Where are the breaching assets, and who controls them? What are the primary and alternate means? How many lanes are there, and where are they located? What is the separation between the lanes? Where is the breach force located before commitment? Who commits the breach force? What is the lane-marking technique?
- *Assault*. What fire control measures are in effect, and who controls the transition of firing from the breach to the assault force? Are there protective obstacles between the breach and the objective? Who is responsible for breaching these and with what systems? Who assumes traffic control through the breach?

These questions need to be answered with clarity and rehearsed at the CAR for SOSRA to be synchronized, while setting up successful breaching operations during the battle.

However, even in answering these questions, the process is not complete. A fundamental of successful synchronization is effective command and control. As previously mentioned, current doctrine does not discuss a crucial aspect of command and control—determining who is responsible for key decisions. As part of the planning process, the brigade staff must identify those responsible for critical decisions and make sure they are addressed in the decision matrix and at the CAR. Table 3 is a guide to assigning responsibility for key decisions of breaching operations.

The bottom line is that engineers are the doctrinal experts regarding breach planning, rehearsals, and operations. If we plan and rehearse according to our published doctrine, and help the maneuver commanders understand this doctrine, we will be more successful at the breach. The "proof in the pudding" is our ability to discuss SOSRA in detail at the CAR in order for SOSRA to indeed be "in effect."

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SFC Petersen is the engineer battle staff NCO observer/controller at CMTC. Previous assignments include assault section sergeant/combat engineer vehicle commander, 82d Engineer Battalion, and assault and obstacle platoon sergeant/operations sergeant in the 58th Engineer Company, 11th Armored Cavalry Regiment (Opposing Force), Fort Irwin, California.

Rear-Detachment Risk Management Options

By Mr. Fred E. Fanning and Mr. Carter T. Boggess, Jr.

With the fast pace of today's Army, it would be easy to overlook the details of deployment preparation. However, we must diligently complete these preparations in order to ensure a successful deployment for all. Part of this preparation should include consideration for hazards faced by rear detachments and the families of deployed service members. The overall risk management of the deployment should be done as an integral part of deployment planning. It should be a part of the military decision-making process and must include rear-detachment operations and families.

There are seven primary areas that should be addressed, in addition to the normal hazards: geographic location of the unit, geographic location of services, leadership experience, leadership training, planning, training/exercise schedule, and family support (see Table 1). Geographic considerations are more important for the Army National Guard, Army Reserve, and organizations outside of the continental United States. Leadership experience and training are key for all rear detachments. The farther down you go from the rank designed to command a unit, the more risks you assume.

The geographic location of the unit (if separated from its parent unit), as measured in driving time, can cause or contribute to the hazards of operating a motor vehicle—one of the most dangerous things rear-detachment personnel and family members do. The hazard is determined by comparing the type of unit with the driving time. This can range from thirty minutes to well over an hour. The longer the driving time, the more risk involved.

Geographic location of services involves distances from services measured in driving time. Again, this measures the risk involved with operating a motor vehicle to obtain services. These measurements are by service type, which would include the hospital, dental clinic, family assistance center, commissary, post exchange, and recreation services. The more important the service, the more times personnel are likely to visit it. The second measurement can be the miles that must be driven to get to the service. The more important the service, and the more driving time, the more risk involved. However, additional risk is often present if essential services are not provided. Many of us can live for a short time without a library, but if a medical facility is a great distance from our home and we have no transportation, the risk becomes high that we will not have appropriate medical treatment when it's needed.

Leadership experience can cause or contribute to accidents in many ways. The most obvious is that lower-ranking military personnel normally have less knowledge, skills, and abilities than higher-ranking personnel. This is due to the training, education, and job experience of a normal career. Leadership positions for rear detachments often range from brigade-command level down to platoon level. If you compare this with the individual assigned as the rear-detachment commander, you can obtain a risk level. The rear-detachment commander at the brigade level might be a captain, while the company rear-detachment commander might be a sergeant first class. Units can also offset this risk by providing training to personnel to prepare them for the duties and issues of rear-detachment command. With training provided, you can

Rear-Detachment Risk Management	
Geographic location of the unit	Distance from parent unit in driving time compared with unit type
Geographic location of services	Distance from services in driving time compared with service type
Leadership experience	Leadership position held prior to rear detachment compared to rear detachment command level
Leadership training	Type of training provided and the level of rear detachment command
Planning	Preparation guidance compared to time for preparation
Training/exercise schedule	Operating tempo guidance compared to type of training
Organized family support group	Includes access and availability of privately owned vehicles, commercial transportation, telephones, a family support group alert roster, and a medical and dental facility

Table 1

compare the rank of the individual assigned with the training received. The training can be in the classroom, on the job, or both. Without any training, the risk may be high; with classroom and on-the-job training, the risk could easily be reduced to a low level.

Planning preparation and guidance will still be necessary for the rear detachments and family member activities. Planning is often measured as in-depth, adequate, minimal, vague, implied, and specified. The more time that can be provided to the rear-detachment commander, the lower the risk during mission execution. The general rule of thumb is to take one-third of the time allotted to conduct your planning and then give the subordinate unit two-thirds of the time for them to plan. This allows additional time for rear-detachment commanders who have little planning experience.

Training and exercises will still be conducted at the rear-detachment level. The operating tempo, compared to the guidance provided, determines the risk level. A field training exercise or a command post exercise with good guidance present less risk than an exercise with medium or low guidance.

Whether or not a unit has an organized family support group determines the risk level of family members while the service members are deployed. The better organized and the lower the unit level, the less the risk. These support groups can provide invaluable assistance to family members that can reduce their risk. It also relieves a great deal of stress on family members when they know they are not alone at this difficult time. Young family members with privately owned vehicles might be at a higher risk than older, more experienced drivers. Furthermore, some vehicles may not be in good working order. Sharing rides or using public transportation through the family support group can produce less risk.

Whether or not family members have access to a telephone can determine the type and availability of medical treatment. Again, the family support group can help family members work through this issue by using neighbors or other means to provide telephone service. Sharing rides and telephone support are made much easier and more effective with a family support group alert roster. This document can be a family member's best friend, by listing other family members who want to help.

You should include the hazards posed by these seven categories just as you would hazards from missions and operations. It works just like the procedures outlined in Field Manual 100-14, *Risk Management*. The leader identifies the hazards present. The highest risk of these initial estimates becomes the initial risk. The leader then identifies risk reduction measures to reduce the risk and then identifies the risk based on the control measures.

After reducing the initial risk as much as feasible without adversely affecting the rear detachment's ability to conduct its mission, we then identify the residual risk. This level of risk is accepted or refused by the rear-detachment commander. The amount of approval authority should be determined in the early stages of the deployment planning process (see Table 2).

This risk acceptance approval authority should be agreed to by the individuals at the various levels of command within the organization. In addition, the risk acceptance levels should be documented in the operations order or operations plan to ensure that commanders and staff at all levels understand who the approval authority is. These levels are based on the knowledge, skills, and abilities of personnel at different ranks. These levels describe the amount of risk each level agrees to accept.

A good safety program must include the particular hazards faced by rear detachments and the families left behind. By including these two areas in the initial risk management process conducted during deployment planning, you can identify and reduce the hazards to rear-detachment personnel and families. The risk management process can and should be updated periodically as the mission and situation changes.

For additional information, please refer to the U.S. Army Maneuver Support Center Safety Web page at *www.wood.army.mil/safety/*.

Mr. Fanning is the safety director, Maneuver Support Center and Fort Leonard Wood. He can be contacted at fanningf@wood.army.mil.

Mr. Boggess is a safety specialist, 89th Regional Support Command. He can be contacted at carter.boggess@usarc-emh2.army.mil.

Rear-Detachment Risk Acceptance Matrix

Risk Level	Approval Level			
	Squad	Platoon	Company	Battalion
Low	Squad leader	Platoon leader	Company commander	Battalion commander
Medium	Platoon leader	Company commander	Battalion commander	Brigade commander
High	Company commander	Battalion commander	Brigade commander	Division commander

Table 2

ENGINEER UPDATE

Commercial numbers are (573) 563-xxxx and Defense System Network (DSN) numbers are 676-xxxx unless otherwise noted.

Directorate of Training (DOT)

WANTED! Applicants for Terrain Analysis Technician Warrant Officer. Military occupational specialty (MOS) 81T NCOs with five to twelve years of service may apply. The duty description is in DA Pamphlet 611-21, *Military Occupational Classification and Structure*. Soldiers may get information on how to become a warrant officer on the home page of the Warrant Officer Career Center at *http://www.leaven-worth.army.mil/wocc/* or U.S. Army Recruiting Command at *http://www.usarec.army.mil/hq/warrant/*.

POC is CW4 Frederick Kerber, (573) 563-4088, DSN –4088; e-mail *kerberf@wood.army.mil*.

Deployment and Mobilization Training. The Department of Instruction has established a contingency operations (CONOPS) training program for students who are likely to deploy after completing their training at Fort Leonard Wood. Students in the Basic and Advanced Noncommissioned Officer Courses, Engineer Officer Basic Course, and Engineer Captain's Career Course have been screened to determine those students with follow-on assignments to deploying and/or deployed units. These students are then given training in four areas: intelligence update, mine awareness, lessons learned from previous operations, and terrain visualization. All four classes focus on the Iraqi threat but also highlight items of interest from operations in Afghanistan, the Balkans, and other locations.

National Guard and Reserve units that mobilize through Fort Leonard Wood also receive focused training from the Engineer School. Many of the units have been bridging units and therefore received additional instruction in river-crossing operations. These units also received training on mine awareness and division- and corps-level operations and instruction on the planning process.

Mobile training teams (MTTs) are a critical element to getting focused training to units in the field. In September, an MTT was sent to Afghanistan to train a cadre of instructors on mine awareness. This team also helped develop a mechanical area clearance SOP. Mine awareness training is the most frequently requested training for both CONUS and abroad.

POC is CPT Ken Boggs, (573)-596-0131, ext 35593; DSN –5593; e-mail *boggsk@wood.army.mil*; or MAJ David Ray, (573)-596-0131, ext 35695; DSN –5695; e-mail *rayda@wood.army.mil*.

Individual Ready Reserve (IRR) Train-Up. As part of IRR call-ups, engineer officers are given refresher training before deployment. They attend a modified Reserve Component Engineer Captain's Career Course for thirteen days with an average nine-hour workday. They receive training in the military decision-making process and brigade and task force tactics. The course is rounded out to meet the needs of the individual by including theater-specific threat analysis, mine awareness, and threat engineer capabilities training. The final phase of the course focuses on the technical engineering issues of force protection, base camp development, road and airfield design, and airfield damage repair.

POC is MAJ Craig Jolly, (573)-596-0131, ext 34128; DSN – 4128; or e-mail *jollyc@wood.army.mil*.

Officer Education System. On 4 February 2003, the Army announced significant changes to the Officer Education System. During 3d quarter fiscal year (FY) 06, the Officer Basic Course will transition to the Basic Officer Leader Course (BOLC). The Combined Arms Staff Course (CASC) will replace the Combined Arms Services Staff School (CAS3) and portions of the Captain's Career Course (CCC). CASC will use both distance and residential learning to prepare officers to take staff jobs. The CASC implementation date is currently 3d quarter FY05. The Combined Arms Battle Command Course (CABCC) will replace the CCC and will focus on training officers to take command. It is scheduled for implementation during 2d quarter FY06. The Command and General Staff College (CGSC) will transition to Intermediate Level Education (ILE). This change will focus educational requirements for majors in their respective career fields. ILE is scheduled for implementation by 4th quarter FY05.

POC is MAJ Storm Reynolds, (573) 596-0131, ext 35747; DSN - 5747; or e-mail *reynoldss@wood.army.mil*; or LTC Jeff Bedey, (573) 596 0131, ext 35647; DSN – 5647; or e-mail *bedeyj@wood.army.mil*.

Stryker Brigade Combat Team (SBCT). The Engineer School continues to work closely with the SBCTs on how to use organic enablers to improve the mobility of the force while operating in the nonlinear and noncontiguous battlefield of a small-scale contingency. In July 2002, during the Senior Leaders Course, assured mobility was introduced to 1/25th SBCT to help it optimize its mobility by using situational understanding as a fundamental enabler.

POC is MAJ Ted Read, (573) 596 0131, ext 37060; DSN – 7060; or e-mail *readt@wood.army.mil*.

Countermine Mobile Training Team (MTT) – Germany. An MTT from the Countermine/Counter Booby Trap Center conducted training from 19-31 January 2003 in Germany. The

MTT instructed members of the 130th Engineer Brigade, 1st Armored Division, and 1st Infantry Division on Mine Awareness Instructor Training (MAIT), Engineer-Specific Countermine Instructor Training (ESCIT), Counter Booby Trap Familiarization (CBTF), Mesa Associates' Tactical Integrated Light-Force Deployment Assembly (MATILDA) Robot System Training, and Handheld Standoff Mine Detection System (HSTAMIDS) New Equipment Training. The team provided a three-hour seminar for senior engineer leaders at Grafenwohr, including a Tactical Minefield Database (TMFDB) overview and the latest National Ground Intelligence Center threat assessment for Iraq. The team also taught a one-day mine awareness course to Corps Support Command soldiers.

POC is LTC Mark Thompson, (573) 596-0131, ext 37347; DSN – 7347; or e-mail *thompsma@wood.army.mil*.

Countermine Mobile Training Team–Kuwait and Afghanistan. From 3-18 February 2003, MTTs from the Countermine/Counter Booby Trap Center conducted training in Kuwait and Afghanistan. Afterwards, the two teams met in Afghanistan to provide instruction on the MATILDA, HSTAMIDS, and TMFDB. The team also provided feedback to Combined Joint Task Force (CJTF) IV in Kuwait on the Mine Intelligence Collection Center (MICC) design for posthostility reconstruction and assisted with the MICC design, organization chart, and mission statement development.

POC is LTC Mark Thompson, (573) 596-0131, ext 37347; DSN – 7347; or e-mail *thompsma@wood.army.mil*.

News and Notes

Unit Seeks Engineer Instructors. Do you enjoy instructing and mentoring soldiers? If so, we may have an opportunity just for you! The U.S. Army Reserve's 1/98th Battalion (Engineer), 98th Division (Institutional Training) (W76H01, W76H02) is seeking highly motivated NCOs and officers from active duty, the National Guard, the Army Reserve, and the Individual Ready Reserve, who are in military occupational specialty (MOS) series 12, 51, or 62 and want to join the Army Reserves as engineer instructors.

Headquartered in New Windsor, New York (near West Point), the 1/98th plans to relocate to Fort Dix, New Jersey, in training year (TY) 04. The unit conducts only two consolidated weekend drill assemblies at its battalion headquarters each year, and the remaining weekend duty is conducted at training sites throughout the northeast. Therefore, unit instructors can teach closer to their homes. Instructor training sites are located throughout New Jersey, New York, and New England.

This table of distribution and allowances (TDA) unit is responsible for engineer MOS training in an eight-state region—New Jersey, Rhode Island, New Hampshire, Connecticut, New York, Massachusetts, Maine, and Vermont. The unit—which trains Active and Reserve Component engineers in MOSs 12B10, 51B10, and 62E10—is scheduled to expand its list of classes to include nearly all 12-, 51- and 62-series training for 10-, 30-, and 40-level soldiers. Besides the MOS-qualified (MOSQ) classes, instructor and small-group courses are also taught.

The 1/98th Battalion currently has the following openings:

Openings	Rank	Title	Branch/MOS
1	MSG	Course manager	Any 12/51/62 series
1	SFC	Supply sergeant	92Y
18	SFC/SSG	Instructor	Any 12/51/62 series
2	SSG	Personnel Staff NCO	74B/71L

If you do not have the specific MOS skill required, the unit can train you to get you qualified and certified. We'll ensure that you complete the Total Army Instructor Training Course (TAITC) and/or Small-Group Instruction (SGI) course before you begin teaching. By completing the TAITC course, you will be granted an "H" designator authorizing you to teach MOSQ classes. This designator is a key differentiator that can enable you to get promoted faster and get the positions that you want!

If you are interested in this opportunity, please contact Catherine M. Burke, the 1/98th Battalion staff administrator at (845)-567-3975, or e-mail *catherine.burke@usarc-emh2.army.mil*.

Civil Affairs Battalion Needs MOS 11B and 12B Soldiers. The 96th Civil Affairs Battalion (Airborne), the Army's only Active Component civil affairs unit, is adding two more tactical companies. One company will be activated in FY 04, the second in FY 05. The battalion needs to fill a total of 84 positions in MOSs 11B and 12B. These positions are part of six tactical teams in the two tactical companies; each team will have a team sergeant, a team engineer, and a team medic.

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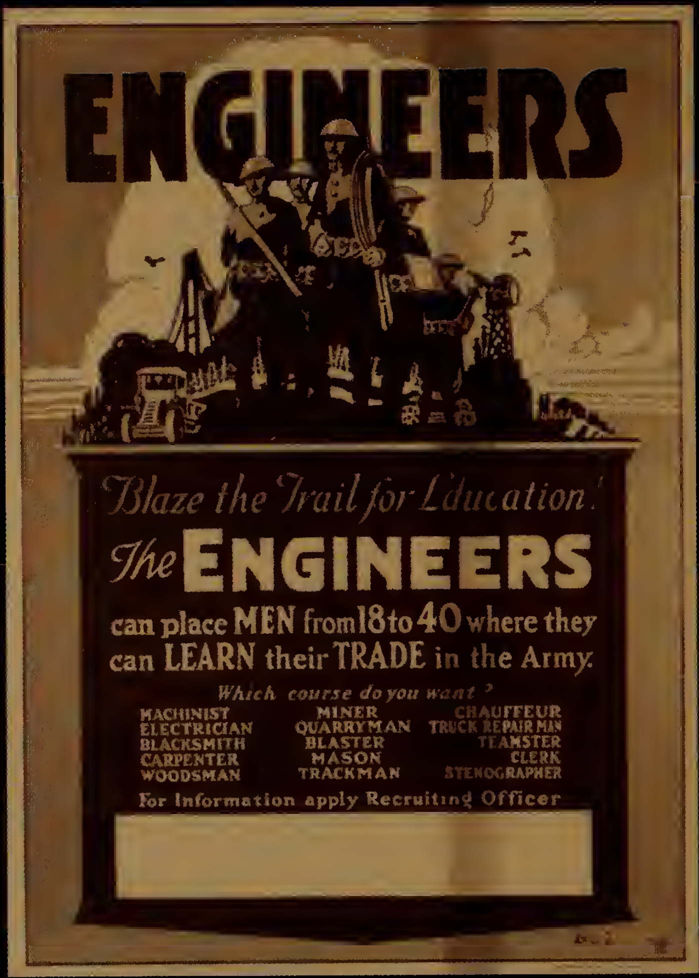
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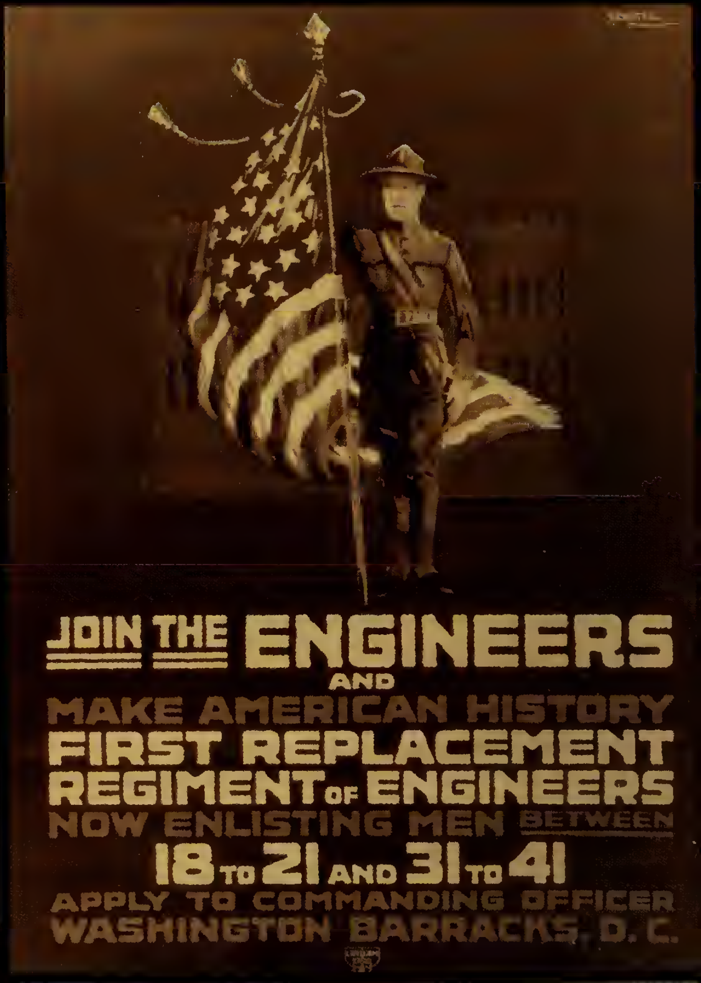
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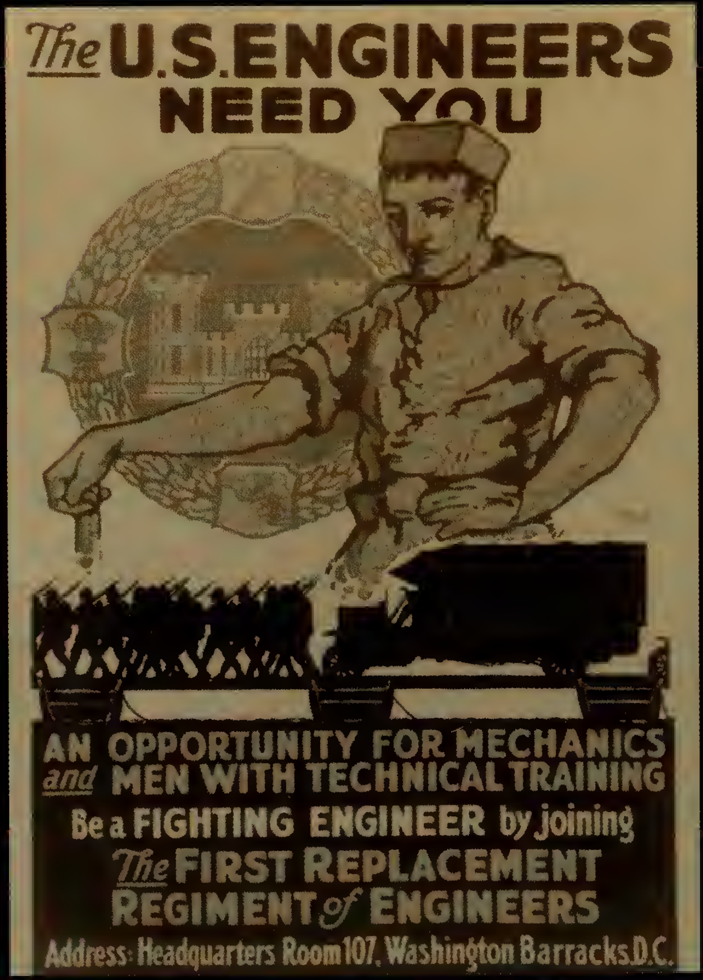
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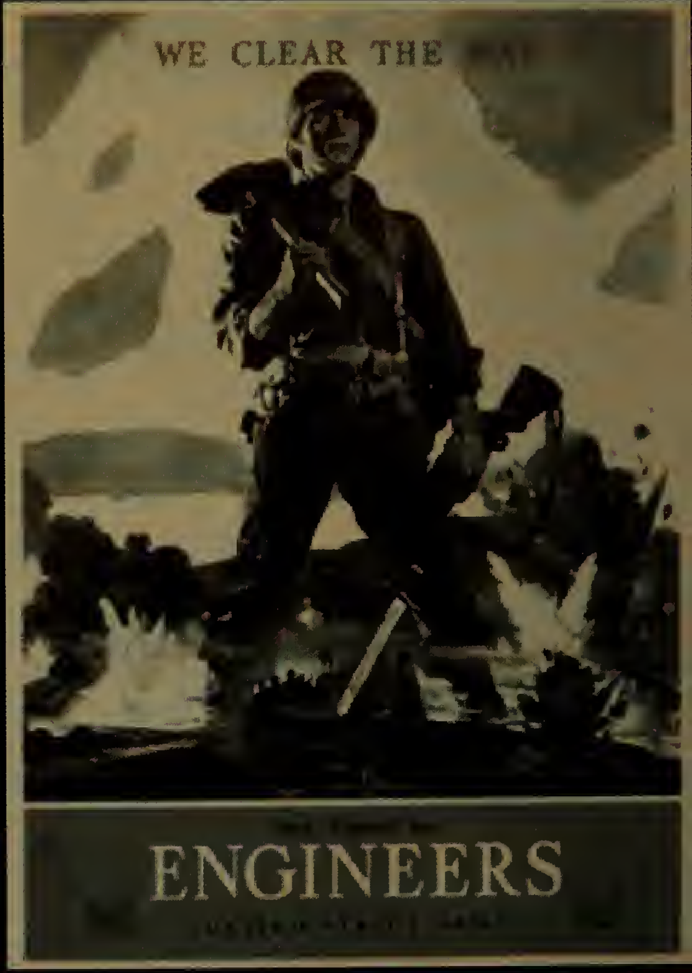
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Engineer (ISSN 0046-19890) is prepared quarterly by the U.S. Army Maneuver Support Center, 320 MANSCEN Loop, Suite 210, Fort Leonard Wood, MO 65473-8929. Periodicals postage is paid at Fort Leonard Wood, MO, and additional mailing offices.

POSTMASTER: Send address changes to U.S. Army Maneuver Support Center, ATTN: ATZT-DT-DS-B *(Engineer)*, 320 MANSCEN Loop, Suite 210, Fort Leonard Wood, MO 65473-8929.

CORRESPONDENCE, letters to the editor, manuscripts, photographs, official unit requests to receive copies, and unit address changes should be sent to *Engineer* at the preceding address. Telephone: (573) 563-4104, DSN 676-4104. *Engineer's* e-mail address is *<pbd@wood.army.mil>*. Our Internet home page is located at *<http://www.wood.army.mil/engrmag/emag_hp.htm>*.

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ENGINEER
The Professional Bulletin of Army Engineers

July-September 2003 Headquarters, Department of the Army *Volume 33 PB 5-03-3*

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Front Cover:
Photo by Andrew Wright, courtesy McGraw-Hill Construction

Back Cover:
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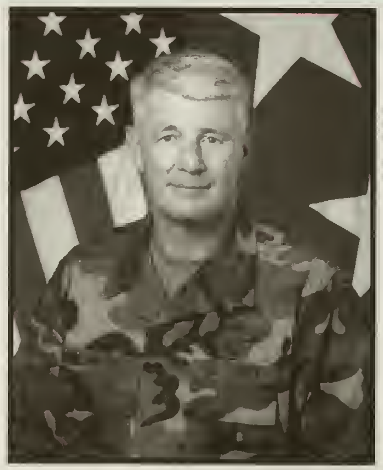
Clear The Way

By Major General R.L. Van Antwerp
Commandant, U.S. Army Engineer School



In the last issue of *Engineer*, we explored the (then named) Objective Engineer Force and its path to transforming our Regiment. As you know by now, we are no longer using the term Objective Force; instead our focus is the Future Force as we continue the Transformation mission.

This issue of the bulletin is focused on aspects of the major combat operations phase of Operation Iraqi Freedom.You will be provided some insights into what happened during the preparation for, and execution of, this complex, tremendously challenging and superbly executed engineer support to Operation Iraqi Freedom. I expect that discussions of the following articles in this bulletin will take place at your professional development (officer and NCO) and command information classes: "Victory Sappers: V Corps Engineers in Operation Iraqi Freedom" by Colonel Martin; "The Inland Petroleum Distribution System" by Captain DeSimone; "Engineer Operations in Turkey Support Operation Iraqi Freedom" by Lieutenant Colonel Nosal; "Army Diver Missions in Iraq" by First Lieutenants West and Inskeep; "Engineer Operations in Urban Environments" by Lieutenant Colonel Funkhouser; "Helping Iraqis Rebuild Iraq" by Colonel Vossler; and "Prime-Power Considerations" by Captain Van Epps. There is much more that we will publish in future issues of this bulletin as we write the next chapters of Army engineer history.

Even though Iraq and Afghanistan remain combat zones, we must begin the analysis and begin to answer "What happened?" From 3 to 5 November 2003, the senior leaders of the Regiment will gather in Savannah, Georgia, to continue the after-action review (AAR) process at the regimental level by coming to grips with the question "Why did it happen?" and begin the discussion on "What do we need to do about it?" We will seek to identify the truly critical aspects of how the lessons learned from Operation Iraqi Freedom apply to engineers in the Current and Future Forces, as well as develop thoughts on how to implement those lessons learned into our Army Transformation efforts.

Seek out lessons learned articles and AARs from engineer units and senior engineer leaders as they are published. They are powerful and valuable learning tools. In some way, virtually all of our Regiment has been affected by the events of the past two years, and I solicit your comments and ideas to help us in the transformation of our Regiment.

It is with immense pride that I serve as the Commandant of the U.S. Army Engineer School. These past months have seen the truth in the phrase: "One Corps–One Regiment–One Team." It has been especially gratifying to see the outstanding readiness displayed on mobilization and arrival at Fort Leonard Wood of our U.S. Army Reserve and Army National Guard engineers. Those citizen soldiers have answered the call and have done what they were asked to do. With nearly 75 percent of our engineer soldiers in the Reserve Component, there is just no way all the engineer missions would have been accomplished by relying only on the active forces.

It is also important at this time to acknowledge the tremendous support our soldiers have received from their family members. Separation, and especially separation involving a family member in combat, is an extra stress component that requires love and special handling. Family Readiness Groups have remained key elements to keeping the home fires burning and an information and support group that lend stability to a traumatic situation. Thanks to all of you.

As the Army's builders, we construct our future from the groundwork of our past experiences. Our true heritage and the history we hold dear was merged from the cement of our values and the blood of our heroes into the enduring concrete that is our Regiment. Our Regiment is people, and when we suffer the losses that we did recently, we must take their inspired service and ensure that those who follow as Army engineers know of their exploits and deeds while facing enemy fire in direct combat operations. We dedicate all that we do to their memory. Essayons!

Sergeant First Class Paul Smith	Bravo Company, 11th Engineer Battalion, Fort Stewart, Georgia
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Staff Sergeant Hollinsaid Lincoln	Bravo Company, 11th Engineer Battalion, Fort Stewart, Georgia
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Private First Class Pablo Manzano	Bravo Company, 54th Engineer Battalion, Bamberg, Germany
Staff Sergeant Mark A. Lawton	Alpha Company, 244th Engineer Battalion, Grand Junction, Colorado

Lead The Way

By Command Sergeant Major William D. McDaniel, Jr.
U.S. Army Engineer School

As I begin this article, it is very difficult for me to express in words my thoughts about the role of the U.S. Army Engineer School Regimental Command Sergeant Major (CSM). This position is not only very important to the Commandant and Assistant Commandant of the School but also to all the soldiers and leaders in the Engineer Regiment. I must state my sincere appreciation to Major General (MG) Van Antwerp and Brigadier General (BG) (P) Castro for allowing me the freedom to accomplish my job and the opportunity to get out and visit engineers throughout the continental United States (CONUS) and outside CONUS (OCONUS).

As many of you know, I was selected by MG Van Antwerp, Commanding General of the Maneuver Support Center (MANSCEN) and Fort Leonard Wood, to serve as his post CSM, and on 19 May 2003, I received my charge during the change-of-responsibility ceremony. In addition to fulfilling the duties of my new position, I will continue to support and cover down on the duties of the Regimental CSM until my replacement, CSM Clinton Pearson, is in place here at Fort Leonard Wood.

Although I only served as the Regimental CSM for eight months, the time between the start and finish date is not important. What is important is what we accomplished together between those dates and the impact we had during that time.

MG Van Antwerp often uses a *bus* to describe key leaders/people in this great organization. He states that it is important to have the right person, on the right bus, in the right seat, at the right time to be an effective organization. I have been extremely humbled, blessed, and honored to serve in this capacity and represent all of you. I believe that I have made a positive impact in our Regiment and that I was on the right bus, in the right seat, at the right time in our history as a Regiment.

In fact, I have been on a great bus with a great team of teams. I have been extremely fortunate to have this opportunity to serve with two general officers who are superb leaders—both very talented and experienced and visionaries in their own right. They demonstrate caring and concerned leadership through their selfless examples daily, and they have taught us all a sense of balance in our lives and profession, which is absolutely essential and necessary in this great profession. They have been great role models for all to follow—with their personal examples of balance—and neither of them just gives this lip service but rather physically demonstrates it every day. As a senior NCO, I have learned so very much from both of them in my personal and professional life, and I am honored to have served with both of them.

I feel that I have managed to bridge the gap in communicating with our CSMs and Sergeants Major from all components (including retirees) within our Regiment. I tried very hard to provide information and to stay connected with them so I could help with their issues. During my time as Regimental CSM, I visited a number of locations throughout our engineer communities. I enjoyed the opportunity to talk to our soldiers and leaders, report their issues and concerns to the Commandant and Assistant Commandant, and then see the Engineer School "Team of Teams" go to work to resolve these issues reported from you in the field. I feel that I have represented all engineer soldiers (Active Component, National Guard, and Reserve—past and present).

These are exciting and trying times for us as engineers. Buzzwords such as *transformation, maneuver support transformation, Future Force engineering, geospatial engineering, transforming the Regiment T3 (transform the Regiment, train soldiers and leaders, take care of [support] the Regiment), force pooling, engineer effects module (EEM), engineer mission team (EMT), engineer mission force (EMF), assured mobility, countermine, counter-booby trap, mine dog team, urban breachers, Officer Education System, NCOES transformation, MOS conversions, MOS consolidations*—and many others—come to mind. A lot is happening in our environment as we look to the future.

I am a soldier with lots of energy and one who always wants to make a positive difference. I don't know all the answers. What I do know is that I love being a soldier, and because of this passion, I will continue to embrace every challenging position with absolute commitment and selfless service. So as I move to the MANSCEN post CSM position and complete this last article to you, I must say thank you for your total support and confidence.

My thoughts and prayers go out to all the soldiers on point around the globe and to all their families during their separation. Remember to always think safety as we accomplish our required missions, regardless of where we find ourselves. Take care of your soldiers, yourselves, and your families. God bless you all, my very best goes out to you, and please stay in touch!

Essayons!!

Victory Sappers: V Corps Engineers in Operation Iraqi Freedom

Part 1: The Attack to Baghdad and Beyond . . .

By Colonel Gregg F. Martin and Captain David E. Johnson

> *"The sappers of the Victory Corps were all over the battlespace, providing value wherever they were employed . . . river crossing operations, building and maintaining infrastructure, conducting stability and support operations, repairing airfields, conducting combat operations—and much, much more . . . all done to an exceptionally high standard . . . each member of this high-energy team is a national hero."*
>
> *—Lieutenant General William S. Wallace*
> *Former Commanding General, V (U.S.) Corps*

A year after the fateful 11 September 2001 attacks, the United States began to assemble a "coalition of the willing" for the second phase of the war on terrorism—the liberation of Iraq. The United States and coalition allies built up forces in neighboring Kuwait and prepared for war. After diplomacy failed, the air and ground forces of the assembled coalition crossed the Iraqi border on 21 March, with V (U.S.) Corps leading the attack as the main effort. The attack, code-named Operation Iraqi Freedom, isolated Saddam Hussein's bases of power in Baghdad and Tikrit. The goal was to eliminate the regime quickly—with a minimum loss of life and destruction of civil infrastructure—in order to rapidly transition to Iraqi civil rule capable of ensuring peace, prosperity, and freedom for the Iraqi people.

U.S. Army engineers played a crucial role during the initial attack and continue to do so during the follow-on stability and support operations and rebuilding effort. Every element of the

An armored D9 dozer clears a road blocked by a destroyed vehicle.

Engineer Regiment has contributed to the fight: Active and Reserve Components and civilians; combat engineers of every type (armored, mechanized, airborne, wheeled, air assault), combat heavy, construction, bridging, and topographic, as well as divers (see article on page 28), fire fighters, well drillers, and utilities/prime-power personnel (see articles on pages 52 and 55), facility engineer detachments and teams, and the U.S. Army Corps of Engineers (USACE). During initial combat operations, engineers assured the mobility of the ground forces, enabling coalition forces to move rapidly north and overwhelm Iraqi military forces. As the high-intensity fighting ebbed, engineers transitioned to stability and support operations, as well as humanitarian civic action (HCA), performing virtually every conceivable type of mission.

Although theater Army, Marine Corps, Navy, Air Force, and coalition engineers all played a vital role in the campaign, this article focuses on the V Corps engineer effort, and in particular, the role of echelon-above-division (EAD) forces. The article first looks at the planning that set the conditions for such a remarkable triumph. It then describes the decisive role that the V Corps engineers played, reviews some of the lessons learned from the campaign, and recommends ways for engineers to improve their performance on future battlefields. The authors concentrate mostly on the planning and high-intensity combat phases of the campaign, as the stability and support operations are still ongoing and the lessons to be learned are still emerging.

Engineer Plan and Task Organization

Engineer planners at V Corps and the various divisions did a magnificent job under very challenging conditions. These challenges came from the compartmentalization of information; the dispersion of key planners and units across multiple posts, countries, continents, and time zones; and the competing requirements of numerous simultaneous real-world missions.

The engineer plan was based on the emerging doctrine of "assured mobility." To support this doctrine, it was crucial for commanders to understand the impact of terrain and weather on military operations. In the V Corps headquarters, the Terrain Analysis Platoon of the 320th Engineer Company (Corps) (Topographic), 130th Engineer Brigade, provided map and imagery analysis that yielded the V Corps commander and his staff products to visualize and understand the terrain. Moreover, each division had embedded terrain analysis teams that could provide similar analysis tools. Further, combat engineers throughout V Corps validated their charge as terrain experts, providing key analysis and timely decision-making products to the maneuver commanders.

Throughout V Corps and the divisions, the true testament of engineers was enabling commanders and staffs to "see" and visualize the terrain to a degree never before witnessed in warfare. The V Corps commander, deputy commander, chief of staff, and key members of the battle staff spent countless hours studying and analyzing special terrain products with the V Corps senior terrain technician and his terrain analysts at their sides—helping key leaders comprehend the impact of the terrain in order to make the right decisions. The 320th Engineer Company and, in particular, the Terrain Platoon embedded in the V Corps battle staff, proved their incredible worth time and again throughout this campaign. Every effort should be made to retain this powerful capability at the corps level to ensure that battlefield commanders continue to have the right tools to make the very best decisions.

For each phase of the operation, planners from the V Corps Staff Engineer Section (SES) estimated the engineer effort required to support the scheme of maneuver. Working with the 130th Engineer Brigade, the SES resourced subordinate units with EAD engineers to accomplish required tasks. The planners identified several missions that were critical to the Corps, such as breaching border obstacles; maintaining main supply routes (MSRs); clearing and opening Tallil Air Base for medical evacuation (MEDEVAC) and C-130 resupply operations; developing logistics support areas (LSAs) and convoy support centers; using bridging assets for multiple river crossings; constructing C-130 and unmanned aerial vehicle (UAV) airstrips and hundreds of helipads; clearing and opening Baghdad International Airport; and providing for the tactical mobility and survivability of the maneuver forces.

Key engineer units were sent to Kuwait relatively early in the deployment process because planners and senior leaders recognized the importance of getting engineers into the theater early.

The engineer plan maximized the support forward to the divisions and accepted risk in the corps rear area. The early-arriving EAD engineer units went to support the 3d Infantry Division (3ID), V Corps's main effort. The 130th Engineer Brigade initially detached its organic 94th Engineer Battalion (Combat)(Heavy) and 54th Engineer Battalion (Combat), along with several multirole bridge companies and the 937th Engineer Group, to reinforce the 3ID division engineer (DIVENG) brigade and its organic units—the 10th, 11th, and 317th Engineer Battalions (Combat). The 94th was organized into force packages and tenaciously reduced obstacles, upgraded MSRs, constructed LSAs, built helipads and airfields, and prepared banks for river-crossing operations. The 54th provided critical combat engineer support to the divisional cavalry squadron, augmented the divisional engineers to weight the main effort, and provided command and control (C2) for both the border crossing and an assault float river crossing. Shortly before the attack, the 130th controlled just a single combat heavy company until follow-on EAD engineer units from Forts Lewis, Carson, and Drum arrived and were able to cross the line of departure. This decision was made to ensure that 3ID was properly weighted with EAD units and set for success.

Follow-on divisions also received EAD engineers. Each division ultimately received an engineer group headquarters to assist with the C2 of EAD engineers within the division's area of operations. This arrangement allowed the divisions' organic engineers to focus forward on providing mobility support to the maneuver elements in the offense. Because the environment was so austere, the requirements for engineers outweighed their capabilities. Given the scarce engineer resources, the priority was to resource the main effort first, then resource the other divisions as additional units arrived. This kept only a modest engineer capability in the corps rear area until well into the stability and support operations phase of the campaign.

Engineer Missions

Throughout the campaign, V Corps engineers performed virtually every conceivable type of mission. In addition, they simultaneously deployed forces; conducted reception, staging, and onward integration (RSOI); attacked into Iraq; and conducted both stability and support operations and HCA missions—bringing together and fighting an engineer force from all components and every type of engineer unit, geographically dispersed over hundreds of miles in combat and over multiple time zones and continents during deployment.

During the attack to Baghdad, the 3ID DIVENG brigade was weighted with the 937th Engineer Group, the 94th Engineer Battalion (-), the 535th Engineer Company (Combat Support Equipment [CSE]), the 54th Engineer Battalion, and several multirole bridge companies. The 130th commanded and controlled the 864th Engineer Battalion (Combat)(Heavy) (plus two additional line companies) and the 642d Engineer Company CSE; the 565th Engineer Battalion, which included the 502d Engineer Company (Assault Float Bridge [AFB]), the 38th Engineer Company (Medium Girder Bridge [MGB]) and the 544th Engineer Team (Dive); and the 320th Engineer Company (Topographic). In addition to supporting 3ID, the 130th also provided EAD engineer support to the 101st Airborne Division and its organic 326th Engineer Battalion, the 82d Airborne Division and its organic 307th Engineer Battalion (-), 3d Corps Support Command, numerous V Corps separate brigades, the V Corps command posts, and Special Forces elements—all this while maintaining MSRs and alternate supply routes (ASRs) stretching 500 kilometers from the Kuwait-Iraq border to Baghdad.

V Corps would ultimately grow to a force of four-plus divisions and an armored cavalry regiment (ACR). However, the attack to Baghdad, destruction of the Iraqi Army, and forced collapse of the regime was conducted principally by 3ID, 101st Airborne Division, 82d Airborne Division (-), and the V Corps separate brigades, supported by the remarkably modest engineer force described in the preceding paragraph. After the fall of Baghdad, the V Corps engineer force grew to more than 19,000 soldiers in 3 brigades, 5 groups, 30-plus battalions, and numerous separate companies and detachments—an enormous force required and organized for subsequent combat, HCA, stability, support, and force bed-down operations that continue throughout Iraq. Some of the major missions include the following:

Improve Bed-Down Facilities

One of the first tasks facing engineer units upon arrival in Kuwait was improvement of the austere bed-down facilities. While most of the base camp construction was handled by theater engineers, V Corps engineers improved facilities by building protective berms, command posts, and ammunition holding areas; constructing helipads and nuclear, biological, and chemical decontamination sites; maintaining and upgrading roads; and providing numerous quality-of-life improvements such as gravel pads, electrical work, carpentry jobs, and drainage. In assembly areas in the open desert, engineers also found innovative ways to build gravity showers and burn-out latrines from the limited materials at hand. Currently, engineer units are focused on constructing force bed-down facilities throughout Iraq.

Breach Border Obstacles

The first critical mission of the war was breaching the border obstacles. Before the attack, American and Kuwaiti engineers moved forward and cleared multiple lanes through the 5-kilometer-deep obstacle belt that marked the Kuwait-Iraq border. The 937th Engineer Group commander was the initial crossing force engineer—with the 54th Engineer Battalion commander serving as the crossing area engineer, responsible for the C2 of division forces as they passed through the breach lanes. Along each lane, combat engineers and military police manned traffic control points, with construction equipment and recovery vehicles nearby to remove blockages. The entire operation had been planned and rehearsed in detail before the attack; all key leaders in the division and corps drove through a full-scale mock-up of the border and the lane-marking system prior to execution. During the actual breach, once 3ID combat units had passed through the border, control of the crossing transitioned from division to corps, with the 130th Engineer Brigade's 864th Engineer Battalion commander assuming the role of crossing force engineer. This handover allowed the 3ID engineers to move rapidly north and focus on the forward fight.

Clear and Repair Runways

The next major corps engineer mission was at Tallil Air Base, southwest of An Nasariyah. Capturing the airfield would allow the coalition to fly attack aviation, MEDEVAC flights, and C-130s closer to the front. A mechanized task force from 3ID, supported by A Company, 317th Engineer Battalion, captured the airfield; however, the runway and the surrounding facilities were unusable because of landmines, unexploded ordnance (UXO), craters, and protective berms. A team of engineers from the 54th, equipped with the M1 Panther II—a modified Abrams tank specially designed to clear minefields—cleared 200,000 square meters of the runway, allowing the first Apache attack helicopters to land. Then B Company, 94th Engineer Battalion, brought dozers, graders, and scrapers to finish repairing the runway for use by Air Force planes and to dig protective positions for the Patriot air defense batteries capable of defending the airfield against attack from Iraqi missiles. In less than 12 hours, the airfield was C-130 capable. Within two days, it was structurally capable of receiving all aircraft types, including C-5s.

Engineer soldiers repair the airfield at LSA Anaconda, near Balad, Iraq.

Maintain and Improve Supply Routes

Maintaining and upgrading the hundreds of kilometers of MSRs and ASRs, ultimately stretching from the Kuwait border to Baghdad, was an enormous and critical mission. As V Corps attacked through As Samawah and on to An Najaf, fierce enemy resistance caused the Corps to divert traffic off the preferred paved highways and onto the inferior secondary desert route to the west, a move that allowed enhanced convoy security.

The huge volume of heavy-duty military traffic quickly deteriorated the already substandard Iraqi pipeline road, which had become the V Corps MSR. Much of the road had to be upgraded and widened to accommodate the thousands of heavy trucks hauling fuel, ammunition, water, and supplies to the forward units—only to return to Kuwait to retrieve more supplies and drive north again. Large stretches of the road disintegrated into "moon dust," requiring the two combat heavy battalions and CSE companies to perform herculean efforts in maintaining and upgrading these routes under extremely adverse weather and combat conditions.

Build LSAs

The two combat heavy battalions and CSE companies also built five enormous corps and division LSAs that leap-frogged from southern Iraq, north to Baghdad, and beyond to Balad, which was conquered by 4th Infantry Division (4ID) in mid-April. While the divisions were still in direct contact with nearby enemy forces, engineers built these critical logistical support bases that included construction and maintenance of UAV runways, C-130 and larger airfields, hundreds of helipads, cargo distribution centers, convoy support centers, fuel bag farms, water distribution points, field hospitals, enemy prisoner of war holding areas, and hundreds of kilometers of force protection berms, as well as improvement of nearby MSRs. After the fall of Baghdad, engineers began to focus on force bed-down and quality-of-life improvements in the LSAs and forward operating bases.

Provide Survivability/General Engineering Support

While divisional engineers fought the close fight, EAD engineers provided critical survivability and general engineering support for divisional, corps, and Special Operations Forces all over the battlefield, to include the battles for As Samawah, An Najaf, Karbala, and Baghdad. With such a relatively small engineer force operating over several hundred kilometers of battlespace, the key to success was in splitting battalions, companies, and platoons into small, mobile teams based around functional capability. While the battalion headquarters managed large projects like constructing an LSA, these smaller modules were given orders to move rapidly to the needed locations and aggressively execute high-priority missions. The impact was enormous as these modules maneuvered independently around the battlefield, rapidly providing critical engineer support. The standard package consisted of a dozer team, a bucket loader, a small emplacement excavator (SEE), a dump truck, and a vertical squad. This module could move rapidly and make an immediate and significant impact in handling a wide variety of survivability and general engineering missions. Based on the mission, enemy, terrain, troops, and time available (METT-T), this package was easily augmented with other equipment to handle larger missions. The flexibility, power, and speed of these modules ensured that units received responsive engineer support throughout the V Corps area of operations.

Construct and Repair Bridges

The ability to cross rivers was key to V Corps's operational maneuver. The Iraqi army rigged nearly all of the major bridges across the Euphrates River for demolition and succeeded in damaging several. Fortunately for V Corps, most of the key bridges were captured at least partially intact. Engineers emplaced numerous MGBs across damaged spans and conducted one AFB crossing under fire, just south of Baghdad. This heroic assault across the Euphrates River, the last natural barrier between the coalition forces and Baghdad, set the conditions for the final attack on Baghdad. Shortly after the fall of Baghdad, in Saddam Hussein's hometown of Tikrit, the 565th Engineer Battalion assumed control of a combined arms task force of more than 1,000 soldiers and emplaced a 536-meter AFB over the Tigris River in support of the 4ID. This became one of the longest float bridges ever built in a combat zone. It was completed on 28 April, Saddam's birthday, and was therefore nicknamed the "Birthday Bridge." The damaged fixed bridge was later reopened with two Mabey-Johnson logistic support bridges, also constructed by the 565th. During subsequent stability and support operations, engineers have emplaced numerous Mabey-Johnson bridges and MGBs throughout Iraq. In addition, a heavy dry support bridge was emplaced for the first time in combat, in support of the 101st Airborne Division in northern Iraq.

Conduct Urban Operations

Engineers played a key role in the urban battles of As Samawah, An Najaf, Karbala, and Baghdad. Combat engineers provided excellent mobility support, fighting alongside tanks and infantry. During military operations on urbanized terrain (MOUT), engineers knocked down walls with M9 armored combat earthmovers (ACEs) and explosives; cleared roads blocked by mines, destroyed vehicles, or rubble with armored D9 or mine-clearing armor-protected (MCAP) D7 dozers; built hasty road blocks for force protection and traffic control; and destroyed caches of weapons and ammunition. Although many missions were not standard engineer tasks, engineers from many units exhibited technical and tactical proficiency and an excellent ability to improvise. Of particular note, the armored D9 dozers were tremendously effective in MOUT, as they were the lead combat vehicles into several urban battles.

Repair Infrastructure

As the southern cities of As Samawah, An Najaf, and Karbala were liberated, engineer assessment teams began working with local civic leaders in assessing and beginning the repair of Iraqi infrastructure—often only a few blocks from where the fighting continued. Forward Engineer Support Teams (FESTs) from USACE were key to this effort, as was a strategy to hire local Iraqis to provide construction materials, equipment, and services as rapidly as possible to repair and build Iraqi civil infrastructure, as well as military infrastructure and bases. This strategy had two purposes: to put Iraqis back

The "Birthday Bridge," over the Tigris River, is one of the longest float bridges ever built in a combat zone.

> *"The one BOS that has been consistently critical at every phase of the campaign—from the border obstacle breach, all the way through the attack, to current stability and support operations—and has performed uperbly and come through big time for the Corps at every turn . . . has been the engineers . . . .The engineers have been the most flexible, versatile, multipurpose, and important force—from start to finish—in the campaign . . ."*
>
> *—Major General Walt Wojdakowski*
> *Deputy Commanding General, V (U.S.) Corps*

to work as quickly as possible in rebuilding their own country, which would generate employment, stimulate the economy, and generate pride in themselves and their communities; and to mitigate the theaterwide shortage of both engineer troops and construction materials. Initiated by the 130th Engineer Brigade early in the campaign at LSA Bushmaster in southern Iraq, this effort grew steadily, reaching new heights with 3ID in Baghdad, and it continues to be a main effort of coalition forces throughout Iraq.

Provide Community Assistance

During the transition from combat operations to stability and support operations, engineers played a key role in civic action operations. The most prominent example has been "Task Force Neighborhood," an initiative of then V Corps commander, Lieutenant General William Wallace, whereby coalition forces help Iraqis clean up and rebuild their country—one neighborhood at a time. The basic concept is to put engineers in command of a combined arms task force consisting of construction equipment and soldiers and medical, dental, military police, civil affairs, psychological operations, public affairs, combat camera, and explosive ordnance disposal (EOD) personnel.

The original Task Force Neighborhood was in Baghdad in support of 3ID. The V Corps commander gave the mission to the 130th Engineer Brigade, which put the 94th Engineer Battalion in charge. The V Corps commander directed the task force to go into the poorest neighborhoods of Baghdad first to help the people who were most neglected and disadvantaged during Saddam's reign. The effect was dramatic and significant, as engineers provided much-needed assistance for the community's immediate needs, made assessments of their long-term requirements, and reassured them of America's positive intentions. Engineers hired and employed hundreds of local Iraqis to help do cleanup and repairs. Together they hauled away thousands of tons of accumulated trash, cleaned up and repaired numerous schools and hospitals, disposed of thousands of UXO, repaired playgrounds and sports facilities, and worked to restore basic services. Such efforts have been instrumental in improving relations with the local communities, getting Iraqis to rebuild Iraq, and paving the way for the eventual return of Iraqi civil government. This concept has become the cornerstone of current stability and support operations efforts, with each of the divisions developing its own version of Task Force Neighborhood, to include the innovative Task Force Graffiti and Task Force Pothole developed by the 101st Airborne Division in Mosul. Perhaps an Iraqi journalist in Baghdad best summed up the value of Task Force Neighborhood when he said, "No one has ever cared about this neighborhood or these people before, until you, the Americans, came. Thank you." (For more information, see articles on pages 42 and 62.)

Perform Nonstandard Missions

Throughout the campaign, engineers performed a wide variety of nonstandard missions that were critical to the success of V Corps. These missions included conducting boat-mounted riverine patrols; hauling, storing and destroying captured enemy ammunition and equipment; burying dead enemy soldiers; collecting, hauling, and disposing of enormous quantities of trash and garbage; and performing numerous civil-military support operations to help the Iraqi people. In taking on and accomplishing these important nondoctrinal missions, the engineers of V Corps enhanced the historic reputation of Army engineers as being the most flexible, multifunctional, can-do, make-it-happen soldiers on the battlefield.

What Went Well

Assured Mobility Concept

Operation Iraqi Freedom validated the emerging doctrine of assured mobility. In a dynamic operational environment, engineers should focus on ensuring the uninterrupted mobility of the maneuver forces as an outcome, rather than a specific task or battle drill. During the operation, engineers succeeded by using terrain analysis to anticipate potential problems, providing technical advice to maneuver commanders, developing flexible organizations able to anticipate and react quickly under rapidly changing circumstances, and training to the highest level of individual and collective competence.

Aggressive, Rapid Execution

The key to aggressive, rapid execution was moving small modules rapidly to the decisive point on the battlefield where they could make an immediate impact. A solid but partial solution on the battlefield NOW is far better than a more complete and thorough solution that is too late. We were all amazed at the engineer effects that these small modules could deliver at the decisive time and place in the corps-level fight.

Training Philosophy

Much of our success was due to a home station training philosophy that concentrated on "doing less better." Training on the core battle tasks at individual, crew, squad, and platoon levels helped develop soldiers, junior leaders, and units that are flexible, adaptive, and competent—capable of adjusting to new situations and finding innovative solutions to problems.

Terrain Analysis

The engineer terrain analysis and visualization capability returned great dividends, allowing maneuver commanders at all levels to understand the effects of weather and terrain on military operations and enabling engineers to anticipate and adequately resource potential requirements. At the corps and division levels, dedicated topographic units provided support for planning staffs. At the battalion level, many engineer units had developed tactics, techniques, and procedures (TTP) for providing responsive terrain analysis support directly to their supported maneuver commander. Our success in this arena—both at corps and division levels—demonstrated the value of the 320th Engineer Company (Topographic) and validates the requirement for a topographic company and its terrain platoon at corps level.

Engineer Headquarters

Engineer headquarters played an important role as C2 nodes in the campaign. EAD groups and battalions were able to command and control forces at critical nodes, freeing up the engineer brigade and the divisional battalions to focus forward on the close fight. Engineer headquarters are particularly well suited for this task because these critical nodes are often located at potential mobility bottlenecks. For example, engineers controlled the Iraq-Kuwait border crossing, the Karbala Gap crossing, and multiple crossings over the Tigris and Euphrates Rivers. At the Birthday Bridge in Tikrit, the 565th Engineer Battalion controlled a 1,000-soldier task force of engineer, infantry, air defense, and signal units and coordinated additional support from a combat heavy battalion, a corps wheeled battalion, and numerous bridge companies. Although current wisdom from the business schools advises organizations to flatten and reduce the numbers and layers of headquarters, this runs counter to our experience in this campaign, where several levels of engineer headquarters multiplied benefits rather than inhibited success.

Combat Heavy Battalions and CSE Companies

The combat heavy battalions and CSE companies were critical throughout the entire campaign. They were the tip of the spear for the border obstacle crossing and in providing tactical mobility across rough desert terrain—often out in front of attacking armored forces. These units maintained MSRs and constructed LSAs and convoy support centers along the hundreds of kilometers of roads between the Kuwaiti border and Baghdad. Without this effort, V Corps would not have been able to push follow-on units or supplies forward along the substandard Iraqi road network. They constructed or repaired five airstrips, hundreds of helipads, hundreds of kilometers of force protection berms, and much more. They built the access and egress ramps and performed the bank preparation that enabled river-crossing operations. The superb effort of our combat heavy battalions and CSE companies guaranteed the operational mobility, and enhanced the tactical survivability, of coalition forces. Every effort must be made to increase the number of these enormously capable units in the Active Component force structure. The notion that these types of units can or should be replaced by contractors is sheer foolishness. And this campaign proved it.

Embedded Key Enablers

Infrastructure repair and construction were enhanced when key enablers and competencies were embedded inside of executing units. Critical elements were a construction management section with solid technical engineering expertise, a civil affairs team, Arab linguists, and dedicated contracting support.

Reach-Back Capabilities

One of the new capabilities that engineers brought to this campaign was the ability to reach back to military and civilian engineers and harness their experience and expertise. This began with the FEST–Augmentation (FEST–A), which provided technical assistance and the ability to access USACE resources around the world. FEST–As have been critical throughout the campaign on both military and civil engineering. Another critical asset was the TeleEngineering Tool Kit, which enabled engineer reconnaissance teams to send pictures and measurements back to the Engineer Research and Development Center or the Waterways Experimentation Station for technical assessments, bridge classifications, and engineering solutions. These kits were widely used all over the battlefield, from damaged runways, bridges, and electrical power stations to MSRs, helipads, and demolitions work. In addition, they provided a powerful communication capability that allowed engineers to conduct daily videoteleconferences for communication, coordination, and situational understanding. Finally, cooperation and on-site technical advice (which started at the Campo Pond bridge training site in Hanau) between military and civilian engineers paid off with the emplacement of Mabey-Johnson bridges in combat.

D9 Dozer and M1 Panther II

These two items were big winners in combat and should be programmed and fielded into the Army inventory. They must however, come with organic transportation, communications, crew-served weapons, and dedicated operators.

Engineer/Sapper Spirit

Engineers were everywhere on the battlefield, and their hallmark was an amazing can-do spirit. The V Corps commander frequently praised his Victory Sappers for their enthusiasm and "any mission-anywhere-any time" attitude. Their initiative, flexibility, adaptability, dedication, and professional expertise were incredible. Their team spirit in supporting the commander was second to none. Their raw courage and bravery on the battlefield were an inspiration to all.

What Needs Improvement

An Aging Fleet of Equipment

Despite their superb performance, engineer units have some of the oldest equipment in the Army. For combat engineers in particular, much of the equipment was unable to adequately support the maneuver units.

Armored Vehicle-Launched Bridge (AVLB). Based on the M48/M60 chassis, the AVLB is both slow and difficult to maintain under the best of circumstances; continuous operations and an extremely austere logistics environment made the task even harder. The maintenance problems were exacerbated by recovery problems. The AVLB should be replaced by the Wolverine. Much of the construction equipment in combat heavy units and CSEs is in the same condition and must be replaced.

M113 Engineer Squad Vehicle (ESV). The ESV often lagged behind the maneuver forces it was supposed to support. In addition, it did not offer enough protection against enemy fire. Despite their need for mobility support, some maneuver commanders became unwilling to commit their scarce engineer assets forward into the fight for fear of losing them to enemy fire. The Army must outfit armored engineers in an appropriate vehicle that can keep up with the maneuver forces it supports and that offers adequate force protection.

Mine-Clearing Line Charge (MICLIC) and the Volcano. These two key engineer weapon systems—both mission-essential in the combat training center environment—did not meet expectations. During Operation Iraqi Freedom, the Volcano was never fired, and only one MICLIC was fired. For scatterable mines, the release authority was held at the Combined Forces Land Component Commander level; during a rapidly moving campaign against an ill-defined enemy, it is nearly impossible to identify a target and get timely approval to use scatterable mines during a short window of opportunity. For breaching, a more effective technique was either to physically remove the mines or to conduct a mechanical breach with a D9 or an MCAP D7 dozer; an M1 Panther II; a tank with a plow; or an M9 ACE. Given the real-world limitations of both the MICLIC and the Volcano, we should invest in other means to accomplish the intended effects.

Signal, C2 Package, and Logistics Support

For EAD engineers, three special shortfalls emerged: First, although EAD engineers operate throughout the division and corps battlespace, they often were not high enough on the priority to receive dedicated support from corps signal assets and often operated away from divisional signal support. Without the ability to communicate, EAD engineers lost some of their ability to operate independently, provide the mobility portion of the common operational picture, or to serve as key C2 nodes for the division. Second, EAD engineers did not have the same C2 hardware and software that the division was using. This diminished their ability to see and understand the battlefield to the same degree as their maneuver brethren. Third, the logistics systems were not flexible enough to support the dynamic and fast-moving role that EAD engineers played within the division and corps areas of operation. In particular, maintenance (especially Class IX) and construction materials (Class IV) were a constant challenge. These issues need to be worked hard before the next conflict.

Rapid Helipad Construction and Dust Control

There was an enormous demand on engineers to rapidly construct hundreds of helipads in the desert. The dust, dirt, and sand caused dangerous brownout conditions that damaged the aircraft and caused several crashes. The best and fastest method to meet the demand for helipads was to install Mobi-Mat pads. Fast to emplace and extremely effective, this material should be purchased in sufficient quantities and issued to both divisional and EAD engineer units—PRIOR to crossing the line of departure.

Recommendations

Continue to develop assured mobility into doctrine. Develop corresponding mission-essential task list changes, training models, evaluation tools, and TTP for implementing the doctrinal framework. Organizations need to include enhancers such as topographic, engineer reconnaissance, and reach-back capabilities. For example, each division and separate maneuver brigade or ACR needs a FEST–A. TeleEngineering Tool Kits must be fielded to every engineer battalion and ACR engineer company. Another critical component of assured mobility is the ability of engineers to conduct MOUT effectively. (See article on page 32.)

Combat engineers supporting maneuver forces need comparable training and modern equipment to be combat capable and relevant for the maneuver commander. In particular, engineers need a more survivable and capable squad vehicle, preferably one that uses the same chassis as the infantry and armor it supports. Sappers also need equivalent enhancers, such as thermal sights and night-vision capability. MOUT training should receive greater emphasis and Engineer Qualification Tables should include mounted gunnery so that engineers are better trained to fight alongside tanks and infantry. Engineers should be included in fielding distribution plans with the maneuver units they habitually support—and not as separate fieldings.

During combat operations, EAD engineers will be task-organized in functional teams to perform specific missions. To prepare for combat, units should develop, train, and employ force enhancement modules (FEMs) designed around capabilities rather than units. (See "Transforming the 130th Engineer Brigade...One Step at a Time," *Engineer*, May 2001, pages 52-60; and "Operation Enigma Strike: Testing the Deployability of the 130th Engineer Brigade FEMs," *Engineer*, April 2002, pages 41-43.) Deployments and decentralized training are the preferred mediums for training the junior leaders who will form these modules and operate independently across wide areas of operation. Such leaders must be flexible, adaptive, and innovative—able to make things happen based on a clearly articulated and understood commander's intent.

Engineers must work more closely with the Ordnance Branch on EOD. The requirement for the destruction of weapons caches, ammunition dumps, and UXO quickly outstripped the resources of the EOD units, and combat engineers picked up the excess. With greater mutual cooperation and training, combat engineers and EOD specialists could work together to relieve much of the workload for routine demolitions and free up dedicated EOD teams for unusual situations or emergencies.

Two months after the capture of Baghdad International Airport, there were virtually no international construction contractors operating in Iraq, and military construction units continue to perform nearly all heavy construction. That contractors could or would do what the military engineers have done during combat and the early stages of stability and support operations is an ill-conceived fantasy, with no basis in reality. And this operation has clearly demonstrated that fact. EAD engineers are critical enablers for divisions during sustained operations. The Army needs to retain as many combat heavy battalions and CSE companies on active duty as possible. The general engineering effort they provide is an engineer core competency that cannot be contracted to civilian engineers during combat operations. The Engineer Regiment must champion this cause, as most of the Army never sees these units in action. General engineering requirements are usually ignored in peacetime training and computer-based Warfighter exercises—or they are performed by civilian companies like Brown & Root—and therefore the force regularly underestimates their value.

All EAD engineer units must be structured to operate independently and form multiple functional modules for particular missions (for example, a C2 headquarters for a river crossing, an MSR team, and an airfield team), to include personnel and equipment for C2. Consider developing multifunctional battalions with an extremely robust C2 infrastructure. As an example, the 565th Engineer Battalion (Provisional) performed great service during the crossings of both the Tigris and Euphrates Rivers. This battalion should be formally recognized, activated, and manned.

On behalf of all the Victory Sappers, we express our deepest thanks, respect, and admiration to Lieutenant General William S. Wallace, the former V Corps Commanding General. His clear intent and power-down leadership ensured that his sappers always knew what to do and took the initiative to get the job done—ALL OVER the battlefields of Iraq. VICTORY!

In addition, the authors would like to acknowledge the visionary leadership and work of previous 130th Engineer Brigade commanders. Many of their initiatives came to fruition on the battlefields of Iraq, where Army engineers have never been better. SAPPERS IN!

For more information and a video on the V Corps engineers during Operation Iraqi Freedom, see the 130th Engineer Brigade Web site "130th OIF Interactive History" at NIPRNET *<http://www.130th engineers.army.mil>* or SIPRNET *<148.35.87.68>*.

C2 systems such as the Force XXI Battlefield Command - Brigade and Below (FBCB2) and Maneuver Control System (MCS) need to be standardized and pushed to lower levels, particularly for EAD engineers. Engineers also need greater long-range communications capability; terrain information is particularly bandwidth-intensive and overwhelms tactical communications nets. Engineers also need greater transportation capability in order to remain mobile.

Non-modified table of organization and equipment (MTOE) enablers, such as the M1 Panther II and the D9 dozers, were great and must be added to the MTOE along with the supporting prime mover, communications capability, and a mounted .50-caliber machine gun.

Conclusion

"Operation Iraqi Freedom was and is an engineer's war. During the fight, and even more now, the engineers are critical. We cannot do without the engineers."

—Major General Walt Wojdakowski
Deputy Commanding General, V (U.S.) Corps

The Engineer Regiment provided outstanding support to V Corps during Operation Iraqi Freedom. Although the engineers accomplished all of their missions and enabled V Corps to accomplish its historic mission to liberate Iraq, there are many lessons to learn from the high-intensity phase of the war, and there will be many more as we fight to win the peace. Learning these lessons and continuing to develop highly motivated, professional soldiers, units, and leaders—with the right doctrine, equipment, and TTP—will ensure that the Engineer Regiment is ready again the next time the nation calls.

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The Inland Petroleum Distribution System in Kuwait and Iraq

By Captain Anthony De Simone and Major Norm Gauthier

On 14 January 2003, the 62d Engineer Battalion (Combat)(Heavy) from Fort Hood, Texas, deployed to the Kuwaiti U.S. Army Central Command (CENTCOM) area of operations in support of Operation Enduring Freedom. The 62d was the first combat engineer battalion in country and was assigned as a direct-reporting unit to the 416th Engineer Command, the theater-level engineer command from Chicago, Illinois. The unit's job would be to construct the Inland Petroleum Distribution System (IPDS) in preparation for an attack on Iraq—a mission usually reserved for one or more engineer pipeline companies, which are all reserve units. The IPDS would be constructed from Camp Virginia, Kuwait, to Logistics Support Area (LSA) Adder (near Tallil Air Base), Iraq, a distance of about 224 miles. The pipeline was essential, as one of the Combined Forces Land Component Command's (CFLCC's) prestart conditions for the war with Iraq was the completion of the IPDS to Breach Point West on the Kuwait-Iraq border.

Upon receiving the mission, we contacted the 808th Engineer Company (Pipeline) in Houston, Texas, to learn about the construction of an IPDS. They sent us the training manuals and CDs, but we were unable to go to Houston for training due to the short deployment suspense. Eventually, the battalion received the 226th Engineer Company (Combat) (Heavy) and the 808th Engineer Company (Pipeline) in February and March, respectively. The battalion strength averaged 750 soldiers during the time period when the IPDS was constructed.

A soldier from the 62d Engineer Battalion couples a section of the pipeline while an oil fire burns in the background.

IPDS

The IPDS is a rapid deployment, general support, bulk fuel storage and pipeline system manufactured by Radian, Inc. The system has a design throughput of 720,000 gallons per day based on 600 gallons per minute at 20 hours per operational day. The IPDS is transported in military vans (MILVANs) and packaged in sets containing materials to construct a pipeline 5 miles long. Each set fills 13 MILVANs. There are 1,404 sections of pipe, 19 feet long and 6 inches in diameter, that fill nine of the MILVANS. The other four MILVANs contain necessary pipeline parts such as couplings, elbows, hammers, retaining pins, and gate and check valves.

The 19-foot-long sections of pipe are made of aluminum with variable wall thickness. These sections cannot be cut. Instead, each 5-mile set contains 44 pieces of 9-foot-6-inch-long pipe with constant wall thickness that can be cut to length and regrooved. Each piece of pipe is designed with a special single-groove design in order to join pipe sections. When two pieces of pipe are joined, snap-joint coupling clamps hold them together. Each clamp has an integral gasket that makes pipe connections relatively easy. Before installing the coupling, a light coat of petroleum lubrication is applied to prevent the gasket from adhering to the metal pipe in extremely hot temperatures. The coupling holds the pipe sections together by wrapping around the grooves on the ends of the two sections of pipe. The coupling is closed with a special tool (included with the set) and is held shut by hammering a retaining pin into place.

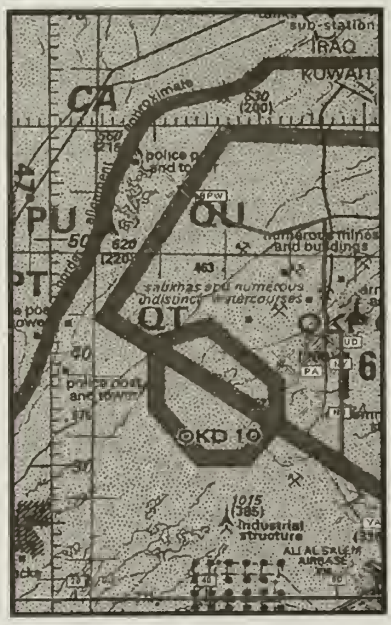
There are a few guidelines to follow when constructing the IPDS. The aluminum pipe used in the IPDS is highly reactive to changes in temperature. Expansion and contraction of the

Soldiers from the 808th Engineer Company construct a pump station in Kuwait.

pipeline can move it almost 2 feet per 50 sections of pipe. Each coupling is designed to handle 4 degrees of deflection, so it is important to control the amount of expansion and contraction. Some ways to control the expansion and contraction are to—

- Install the pipeline as straight and level as possible.
- Make any change of direction by using elbows.
- Construct anchors and "U" or "Z" expansion loops at certain intervals.

Another thing to consider when constructing the IPDS is maximizing fuel flow. To do this, we needed to install pump stations, which consist of two 800-gallon-per-minute mainline pumps, a launcher to launch a pig (a scraper that passes through the line to clean it), and a receiver to catch the pig. The pump is best moved by a rough terrain cargo handler or crane. The launcher and strainer weigh about 2,800 pounds each.



IPDS I runs from Camp Virginia through Camp Udairi to Breach Point West.

Once the IPDS is constructed, it has to be filled and flushed before placing it in operation. The pipeline is designed to run at 600 gallons per minute with each pipe section having a maximum allowable operating pressure of 740 pounds per square inch. Water is pumped into the pipeline and a pressure check is conducted. Once the pipeline passes the pressure check, a pig or scraper is passed through the pipe via the launcher and caught by the receiver. The pig scrapes the sides of the pipe, removing any sand or debris before fuel is added. Behind the pig, fuel is pumped into the pipeline. Once the pig is received at the pump station, that section of pipe is charged with fuel and ready to operate. If there are any problems along the way, a repair crew closes the gate valves and repairs that section of pipe. After these tests are conducted, the pipeline is operational.

To deliver fuel from the pipeline, tactical petroleum terminals (TPTs)—run by quartermaster units—are set up at desired intervals. The mission of the TPTs is to receive, store, and dispense fuel, and millions of gallons of fuel can be stored or delivered to tankers or other vehicles.

How We Did It

Since the war was still months away, we could not construct all 224 miles of pipe simultaneously. As a result, we broke the mission into five segments, IPDS I through IPDS V.

IPDS I

IPDS I stretched from Camp Virginia to Breach Point West (about 51.5 miles) near the Iraq border in preparation for a ground assault. Because we had so many miles of pipeline to construct, six pump stations and two large TPTs to build,

Alpha Company, 62d Engineer Battalion, transports pipe by loading three MILVANs on a lowboy.

and the TPT at Camp Virginia to expand, we broke the pipeline trace into company sections. They then broke their sections into platoon sections. Each company was given a section of the trace and daily goals to meet. At the start of the pipeline, we only had three line companies. We used a planning factor of 2 miles per day per company or about 6 miles per day for the battalion. We trained our leaders on the IPDS on 24 January. Our trainer had been in the 515th Engineer Company (Pipeline) during Operations Desert Shield and Desert Storm, when the company laid more than 100 miles of pipeline. Due to the short duration of the war, that pipeline was never used to pump fuel.

Since our ship had not come into port yet, we borrowed transportation assets (5-ton cargo trucks and high-mobility, multipurpose wheeled vehicles [HMMWVs]) and sent two vertical platoons, one each from Alpha and Bravo Companies. We reserved the other two vertical platoons for port download operations. Construction of the IPDS from Camp Virginia to Camp Udairi began on 28 January 2003.

The ship with our equipment arrived in port on 31 January, and we began download operations the following day. With commercial and heavy equipment transport, we moved the battalion from Camp Arifjan to Camp Udairi on 7 February. We set up our base camp operations, and the next day all six vertical platoons were working on their assigned sections of pipeline. Our plan was to stage two 5-mile sets every 10 miles, but external transportation assets were in demand and routed elsewhere. As a result, we used our M916/M920 and M870 trailers to move pipeline and our 25-ton all-terrain cranes to load the MILVANs.

Pipeline construction continued at a rapid pace as Bravo Company moved its command post to a location just outside of Breach Point West and started construction from there back toward Camp Virginia. The 10-mile segment was primarily on flat ground but incorporated three large crossing sites for maneuver forces. Each 5-mile set of pipeline comes with 80 feet of 24-inch nestable culvert. We were tasked to build ten 100-meter (approximately 328 feet) crossing sites over the 51.5-mile trace, and there were several sites where the pipeline crossed the main supply route (MSR). Since these crossing site requirements exceeded the supplies in the pipeline set, we contracted for the delivery of hundreds of pieces of 19-foot-long PVC culvert with a 13-inch diameter. We modified the pipe layout to ensure that we had gate valves and expansion loops before each large crossing site. By digging with the hydraulic excavator (HYEX), the crossing sites were emplaced easily and didn't hamper progress.

One section of IPDS I that we called the "moonscape" required special attention. It was a 5-mile-long section that passed through rough terrain and sand dunes. The equipment platoon from Headquarters Support Company spent 9 days with seven dozers leveling this area before pipe could be laid there. In all, it took 21 days to complete IPDS I, 5 days ahead of schedule. However, it took the quartermaster personnel an additional 21 days to fill and test the line. Normally, the pipeline construction company would have performed this task, but it had not yet arrived in country. One of the lessons learned for our construction of IPDS II was to incorporate time into the work schedule to fill and test the line.

IPDS II

As the possibility of war increased, the CFLCC projected a larger daily requirement for fuel at Breach Point West. As a result, we needed to construct an additional pipeline parallel to IPDS I. There was one consideration in constructing this section. Pipe and pump stations were only estimated for one pipeline to reach approximately 205 miles. By constructing this second pipeline, issues would arise later on that might prohibit the pipeline from reaching LSA Adder. Equipped with many lessons learned from IPDS I and the addition of the 808th Engineer Company, the battalion was able to complete IPDS II with ease. Alpha and Bravo Companies and the 226th Engineer Company concentrated on pipeline construction, and the 808th focused on pump station construction and filling and testing the line. Headquarters Support Company cleared another trace through the moonscape with Bravo Company.

Challenges

Transportation. External transportation assets were always in high demand. We were forced to transport MILVANS to worksites a few at a time with internal haul assets (M916/M920 and M870 trailers, as well as the Palletized Load System [PLS] with flatracks). Using internal assets, we averaged 6 to 8 miles of pipeline constructed per day. With dedicated PLS support, we constructed 34 miles of pipeline in a 2-day period.

Water. Getting the water required to flush and fill the pipeline was difficult, and we experienced several delays waiting for water. In the end, most of our water requirements had to be contracted out and brought in by commercial assets.

MOPP1. After the completion of IPDS I and II, the ground war started, and all units went into MOPP1. Progress on IPDS III into Iraq slowed because now the soldiers were in MOPP1 and wearing flak vests in temperatures near 120 degrees. Drinking water was essential, as were timed breaks for soldiers. Pipeline sections now took two to three times as long to construct as those constructed before the war.

Rough Terrain and Sandstorms. Most terrain in the desert was flat and ready for pipeline construction. The section in Kuwait that we called the moonscape was difficult to work through. Many days were spent and thousands of tons of sand were moved to prepare the site. At times, sandstorms reduced visibility to less than 20 yards and prevented the pipe seals from staying free of debris. The rough terrain and sandstorms also made it impossible to align the pipeline for anchoring.

Crossing Site Adjustments. A pipeline set includes 80 feet of nestable culvert. We had to build crossing sites 100 meters across for tracked-vehicle maneuverability. Luckily, we were able to obtain 19-foot lengths of 13-inch diameter culvert from Camp Doha and link the pieces together to span the required length.

Extended Lines of Communication. We worked on sections of the pipeline that spanned more than 60 miles at a time. Communications became an issue when our FM radios did not transmit the entire distance. To overcome this problem, we set up retransmission sites in Kuwait. In sections in Iraq, we set up base camps every 15 to 20 miles to maintain communication between base camps.

Tricks of the Trade

Quality Assurance/Quality Control Inspections. Building pipeline can be monotonous, and it was important that the S3 section constantly inspect the construction. Often, we identified and corrected mistakes before they caused major problems. We also checked the line with members of the quartermaster unit that took over the pipeline. If the unit identified any problems, we corrected them before turning the pipeline over to the unit. Another valuable asset was the representative from Radian, Inc., who was in theater throughout our construction of the pipeline. He was truly the expert on constructing the pipeline and pump stations.

The battalion's Bobcats were invaluable in constructing the pipeline.

Internal Transportation and Flatracks. We planned for and requested external transportation but also planned for completing the mission without it. We also requested flatracks for our PLS trucks. This asset enabled us to conduct our own transportation of pipeline MILVANs and pump stations. We did not have the volume of vehicles we would have liked, but we managed to keep our trucks with pipeline MILVANS one day ahead of the soldiers constructing the pipeline.

Lessons Learned

Pipeline Construction. Break the unit into several sections by platoon and give them goals.

Construction Meetings. With our limited assets, a detailed construction meeting was a must. Each commander reported progress and identified equipment needs (from Headquarters Support Company or other) for the following 24 to 48 hours. These were addressed to minimize confusion and lost time and to maximize construction effort the following day.

Security. As you lay and couple pipe, the site moves forward, so security must also be mobile. We used two soldiers at each end of the mobile construction site with the M249 squad automatic weapon (SAW) on top of a vehicle to provide clear lines of sight. We increased this in Iraq by using the M2 .50-caliber machine gun, MK-19 grenade launcher, and AT-4 antitank weapon.

Transportation. You need a dedicated transportation unit with 14 or more PLS vehicles. These will greatly reduce the amount of internal haul assets and increase the productivity of the soldiers constructing the pipeline.

Protecting the Pipeline. The only thing we found effective at protecting the pipeline in the desert conditions was berms. We initially constructed 3-foot berms but found that HMMWVs could still go over the top. As a result, we built dual 6-foot berms.

Bobcats®. The battalion received four Bobcats with all attachments before the pipeline construction began. They were a great asset in pump station construction. We used them for installing both gate and check valves, which are too heavy to lift without several soldiers.

Another consideration when constructing the pipeline was how to protect it. At the time, there were many maneuver units in the area preparing for a ground assault into Iraq. Our initial plan to protect and mark the pipeline was to use 8-foot-tall pickets, flying 3 feet of white engineer tape, every 100 meters. CFLCC then issued a fragmentary order to inform all commands of the location of the pipeline and instruct them not to cross over it. With fuel at 700-plus pounds per square inch, it could be dangerous if the pipe ruptured. While this method may have marked the pipeline, it did not protect it. We then constructed a 3-foot-high berm on one side of the pipeline, which also failed to protect it. Finally, we constructed a 6-foot berm on both sides of the pipeline, and this method proved to be effective. For four weeks, all the dozers in the battalion worked at constructing more than 130 miles of 6-foot berm for IPDS I and II from Camp Virginia to Breach Point West (to include force protection berms for the pump stations and TPTs).

This time, IPDS II (the same 51.5 miles as IPDS I) only took the battalion 12 days to construct and 5 days to fill and test. We finished on 18 March and fulfilled the CFLCC requirement for fuel prior to the ground war. With IPDS I and II complete, there were 103 miles of pipe on the ground, enough to sustain V Corps and I Marine Expeditionary Force (MEF) ground and rotary-wing combat forces.

IPDS III

IPDS III began a few hours after the ground war started. The team, consisting of a HYEX and two squads from the 808th, was attached to the 6th Engineer Support Battalion, Marines out of Oregon. They crossed the border and began digging crossing sites so the battalion could follow with pipe without delay. On 22 March, the remainder of the battalion crossed the border and secured their base camps in Iraq. To maintain FM radio communication, each company established its base camp within radio communication distance. As a result, the battalion had uninhibited communication throughout the area of operation for the new pipeline. This section of the pipeline stretched from Breach Point West in Kuwait to LSA Viper in Iraq, a distance of 58 miles.

Since we were now in a combat zone, soldiers had to take additional safety precautions. For the first three weeks of pipeline construction in Iraq, soldiers worked in their Joint Service Lightweight Integrated Suit Technology (JSLIST) suits (at mission-oriented protective posture [MOPP] level 1), flak vests, and full combat load of ammunition. With all of this gear, production dropped to less than a mile of pipe constructed per day per company, a 50 percent decline in productivity. This reduction was acceptable, as completion dates had been adjusted accordingly.

IPDS III, consisting of 58 miles of pipeline and four pump stations, was finished on 14 April, ahead of schedule. Before the ground war, the initial goal for IPDS III was to extend to Tallil Air Base near LSA Adder. However, a few days into the war the area was still not secure from enemy activity. Consequently, the plan changed from reaching LSA Adder to reaching LSA Viper instead.

A crossing site at MSR Iron Horse Trail

Engineers lay pipe for the IPDS.

IPDS IV

By the time the pipeline reached LSA Viper, LSA Cedar I was secured and was ready for fuel delivery. IPDS IV would extend an additional 29.5 miles from LSA Viper to LSA Cedar I. Construction on two additional pump stations began on 15 April. Each company was given about 10 miles to complete, and progress went smoothly. We were now a seasoned pipeline construction unit, anticipating problems before they occurred. Alpha and Bravo Companies and the 226th continued to construct the pipeline while the 808th focused on pump station construction and filling and testing the pipeline.

An important thing to consider when filling and testing the pipeline is the availability of water. This requirement was always an issue throughout this process. We were in the desert, and water was scarce. To complete the filling and testing, we had to contract local tanker companies to haul water to fulfill our requirements. IPDS IV was completed on 20 April without a hitch, merely 5 days after it was started.

IPDS V

Just when we thought we were done with pipeline construction, we received orders to continue the pipeline to LSA Cedar II, north of LSA Adder. This section would extend the pipeline an additional 34 miles and require three pump stations. However, since we constructed IPDS I and II in Kuwait, we had used more pipe than we scheduled for, and there were no pump stations in country to continue IPDS V.

Simultaneous to our pipeline construction, the Kuwaitis had completed a contract for a fuel pipeline from Camp Virginia to Camp Udairi, so IPDS II was no longer needed. We decided to send platoons from Bravo Company to recover this pipe to construct IPDS V. A platoon from the 226th leveled the berms, and the 808th removed the pump stations. In order for the pipe to be recovered, it had to be flushed with water, uncoupled, and air-dried before handling.

Platoons from Alpha Company and the 226th constructed IPDS V as fast as pipe could get to them and finished it on 13 May. Then the battalion withdrew from Iraq—one company at a time—into base camps in Kuwait and waited for further missions.

Conclusion

When the pipeline construction was finished, the 62d Engineer Battalion had completed the longest operational IPDS ever constructed by the Army. More than 720,000 gallons of fuel could be pumped daily from Kuwait into LSA Cedar II in Iraq, a distance of 224 miles. The soldiers of the battalion moved more than 66,000 pieces of pipe, weighing 4,500 tons. The battalion learned many lessons from conducting this mission. Although a pipeline can be constructed without a pipeline company, we found that with the assistance of the 808th Engineer Company, the battalion's efficiency greatly increased. The 808th also was able to reduce the fill-and-test process by several weeks, which enabled the battalion to meet every deadline early. The 62d Engineer Battalion's success can be attributed not only to having a good plan but also to having superior noncommissioned officers and motivated soldiers. Ensuring that they knew the importance of this mission was directly correlated to the success of the CFLCC mission.

Captain De Simone is the construction officer for the 62d Engineer Battalion, Fort Hood, Texas. He was previously a platoon leader and executive officer in the 52d Engineer Battalion (Combat)(Heavy) at Fort Carson, Colorado.

Major Gauthier is the S3/operations officer for the 62d Engineer Battalion. He previously served as the S3/operations officer for the 91st Engineer Battalion, 1st Cavalry Division, at Fort Hood.

Engineer Operations in Turkey Support Operation Iraqi Freedom

By Lieutenant Colonel Roxanne Nosal, Lieutenant Colonel Randal Fofi, Lieutenant Colonel John McClellan, and Major Shawn McGinley

In the fall of 2002, U.S. Army Europe (USAREUR) was directed to open a northern front into Iraq in support of potential actions against the Hussein regime. The area of operations would include an 800-kilometer line of communications in Turkey with up to 18 different nodes—all requiring acquisition of property, careful environmental consideration, and construction or modification to ready them for up to 60,000 soldiers. A hodge-podge of roughly 3,300 Army and Navy engineers had been identified to perform the mission; however, no headquarters structure was available to oversee the planning or execution. As a result, the reactivation of the 18th Engineer Brigade (theater Army), which was scheduled for June 2003, was moved to 21 January 2003. (See article in *Engineer*, April-June 2003, page 37.)

The reactivation of the 18th Engineer Brigade served two major purposes: First, the core of the brigade headquarters serving as theater engineer planners is fully engaged in the development of operations plans and therefore has the

A Seabee from Naval Mobile Construction Battalion 4 surveys for the logistics support area near Nusaybin, Turkey.

Logistic support areas were constructed primarily through the LOGCAP contract. Shown are bunk beds at Oguzeli.

advantage of anticipating and planning for engineer requirements in a contingency. Secondly, although the U.S. Army Corps of Engineers (USACE) has enormous capabilities that can be brought to bear as required during contingencies, these assets do not typically come with an overarching headquarters capable of integrating small, specialized units (both Active and Reserve Component) where they can best influence the operation. The 18th Engineer Brigade is fully capable and designed to perform this mission. This became evident in Turkey in February 2003.

Operational Concept

The USAREUR mission in Turkey was to establish and operate the infrastructure required to pass combat forces centered around the 4th Infantry Division through southeastern Turkey into Iraq. This mission was considered vital to achieve the U.S. Central Command (CENTCOM) commander's intent of opening a credible northern front against Iraqi forces and fixing up to 13 Iraqi divisions in northern Iraq so they could not shift south to engage coalition forces attacking out of Kuwait.

Army Forces–Turkey (ARFOR–T) was organized around four major units:

- 1st Infantry Division provided overall command and control and force protection for all U.S. ground forces in Turkey.
- 21st Theater Support Command operated the logistics infrastructure and sustained all U.S. forces in Turkey and northern Iraq.
- 7th Signal Brigade established and maintained the communications architecture for ARFOR–T.
- 18th Engineer Brigade acquired the property and built or improved the facilities to support the forces.

The original plan allowed up to 60 days for preparatory work before the arrival of combat forces. This included establishing command and control and force protection, acquiring property, opening three seaports and two airports, and establishing operational nodes along 800 kilometers of highway and into Iraq in the east. Node sizes and complexities varied from basic truck stops for driver breaks along the highway to tactical assembly areas up to 50 square kilometers in size. It was envisioned that, once established, the 4th Infantry Division would flow in over a 28-day period and prepare to attack into Iraq.

With the approach of combat operations and no decision by the Turkish government to allow combat forces to pass through the country, the USAREUR commander decided to accelerate the preparation schedule and to focus efforts on those tasks required to support the combat forces initially. Instead of a 60-day preparatory phase, the USAREUR staff developed an abbreviated plan to rapidly acquire and prepare ports and staging areas for use by the 4th Infantry Division. This plan would take about nine days but would allow the rapid introduction of forces into the CENTCOM operation.

Scheme of Maneuver and Task Organization

To support the general operational concept, the USAREUR staff identified the preparatory tasks that had to be completed to receive and pass the 4th Infantry Division. The 18th Engineer Brigade, serving as the USAREUR engineer prior to deploying to Turkey, determined that the essential tasks included acquisition of properties for ports, airfields, headquarters, and staging areas and the establishment of minimum living and sanitation facilities to support the reception and rapid onward movement of combat forces.

The engineer scheme of maneuver was built around these essential preparatory tasks to meet the CENTCOM timeline and assure the success of the overall operation. The compressed timelines drove engineer planners to adopt a course of action that would initiate all essential tasks simultaneously through contract construction—a combination of Kellogg, Brown & Root Services; the Logistics Civil Augmentation Program (LOGCAP) contractor; and USACE contractors. Military construction units would be focused at the area of greatest need upon their arrival. As essential tasks were completed, engineer effort would be shifted to secondary tasks—mainly those tasks required to sustain ARFOR–T units. If there were sufficient engineer resources in theater, then all tasks would be initiated simultaneously as long as the execution of a secondary task did not interfere with essential tasks. The concept also called for the 18th Engineer Brigade to be prepared to follow and support into northern Iraq as the theater matured and the Coalition Forces Land Component Command (CFLCC) force passed through. Likely missions in northern Iraq would be maintaining supply routes, constructing and repairing bridges, and constructing camps for displaced persons and enemy prisoners of war.

The task organization was built around this concept. The brigade headquarters would be augmented with members of the divisional engineer brigade of the 1st Infantry Division, Forward Engineer Support Teams (FESTs) from USACE, and real estate specialists from the Europe-based Installation Management Agency. The brigade integrated itself into the ARFOR–T with the commander wearing two hats—18th Engineer Brigade commander and ARFOR engineer. The FESTs provided subject matter experts in various fields of engineering as well as contracting officer representatives to help manage contract construction. In addition to construction capability, the brigade's task organization also included base camp maintenance and management capability in the form of facilities engineer teams and prime-power, fire-fighting, and utilities detachments.

Priorities and Execution

Having identified the essential tasks, the brigade planners prioritized them in coordination with 1st Infantry Division, 21st Theater Support Command, and USAREUR planners. The basic rule of thumb was that priority tasks were those tasks absolutely necessary to receive the 4th Infantry Division at the port, lodge them in austere conditions in a tactical assembly area in the east, and allow them to attack with appropriate stocks of fuel and ammunition.

Once in country, the brigade planners devised a master plan for each node. This process called in site survey chiefs, site officers in charge, force protection specialists, the LOGCAP contractor, and members of the security force to define in detail where everything would go and in what sequence. The tasks to be accomplished at each node were further prioritized so there would be no confusion by the contractor. These prioritized statements of work were provided to the contractor through the contracting officer. The 18th Engineer Brigade served a vital role in the development and approval of all statements of work to ensure that the contractor was focused on only essential tasks. New requirements were submitted to a construction review board to review their validity and to a joint acquisition review board for final approval. At this time, projects identified as having a highly technical and discrete nature were passed to the local USACE office at Incirlik Air Base for action. These projects—the Seyhvelet Bridge bypass and the lightning protection system and Agalar Pier—were issued as individual contracts to specialized Turkish contractors.

A 6,700-foot heavy equipment transport bypass for Seyhvelet Bridge

Change of Mission: Increase Support to ARFOR–T

In March, it became obvious that the Turkish government would not make a decision quickly to allow forces into the country. At that time, the ARFOR–T preparatory forces the government of Turkey had allowed in (about 1,800 soldiers) were dispersed throughout Turkey, living under fairly austere conditions and waiting for the go-ahead to continue the mission. With these new circumstances, the ARFOR–T commander shifted the priorities to ensuring an adequate quality of life and providing protection for ARFOR–T soldiers.

In general, this meant shower and sink units and tents/sleeping areas with heat and lights and whatever force protection infrastructure improvements that were deemed necessary. This was a distinct change from the austere approach that had been planned. However, the 18th Engineer Brigade planners were able to quickly modify contract statements of work, and the LOGCAP contractor, with sufficient personnel and materials on the ground, was able to rapidly modify its priorities. The advantage of using the LOGCAP contractor was that it is able to react to changes across a broad front versus having to have individual contracts modified.

Change of Mission: Closure

As the end of March approached and the government of Turkey had not called for a revote on the introduction of combat forces through Turkey, CENTCOM directed the 4th Infantry Division to proceed to port in Kuwait. No replacement force for the 4th Infantry Division was identified. Since the government of Turkey was also requesting the departure of Operation Northern Watch units, it appeared unlikely that any other support to Operation Iraqi Freedom would be approved. As a result, USAREUR directed ARFOR–T to develop a detailed plan and be prepared to downsize the current ARFOR–T capability and place those facilities into a "warm" status required to either pass a small ground force through Turkey (should it be approved) or to maintain a ground line of communication through Turkey to sustain forces in northern Iraq. On 2 April 2003, ARFOR–T directed the reshaping of forces in Turkey and began closure operations.

The key closure tasks focused on an orderly and deliberate reduction in forces and equipment while simultaneously returning properties to the appropriate Turkish owners and harvesting as much U.S. material as practical, while ensuring the protection and safety of all personnel. The 18th Engineer Brigade was charged with forming east and west closure teams to return leased lands and facilities to the private owners or government entities of origin. Each of the closure teams was tailored to its particular geographic and facilities makeup and contained expertise in operations, construction management, real estate, environmental engineering, logistics, contracting, and legal matters.

Much attention was paid to the question of what materials were to be recovered, disposed of, or offered to local owners or military forces. Broad guidance from the USAREUR commander to "recover all U.S. government property and return it to the military system" was translated into specific harvesting guidance addressing various commodities. Customs restrictions were researched to ensure that the unit and node commanders were aware of what materials could and should be loaded into unit containers for return to Europe.

Closures in the east were completed by 16 April and in the west by 26 April, culminating with the return of the port of Iskenderun, the last facility required to redeploy the force. In almost every case, the closure teams completed their missions ahead of original projections for the site. The closure checklists, savvy real estate officers, and some smart decisions by the closure teams streamlined the process and ensured that no additional U.S. funds were spent on property rentals beyond already existing commitments.

Conclusion

The 18th Engineer Brigade was the single agency at the theater level with coordinating responsibilities for all military and civilian engineer capabilities and host nation engineer support, as well as joint and multinational engineer efforts engaged in combat support of a theater of operation. This included the command direction of topographic operations, construction, real property maintenance activities, lines-of-communication sustainment, engineer logistics management, petroleum storage and distribution, and base development. During the deployment to Turkey, the 18th Engineer Brigade managed $13.8 million of real estate acquisitions and utilities, $28.1 million of LOGCAP construction, $992,000 of USACE contract construction, and $108,000 of materials for military construction. No single construction delivery method could have met the timeline originally proposed. Only a combination of military engineers, LOGCAP construction, and USACE contractors could have completed the mission on the originally proposed timeline. Having a theater Army engineer brigade managing all of the engineer effort for the Army in the theater allowed the most efficient and cost effective construction delivery method for each situation and made it possible to modify the plan as external forces caused the situation to change.

The theater Army engineer brigade is a unique organization, capable of providing engineer support across the spectrum of military operations depending on which elements are attached to it during the operation. The ability of the organization to be responsive, agile, and versatile is in keeping with the objectives of Army Transformation and will ensure the best possible support to the Future Force.

Lieutenant Colonel Nosal is the G5/NATO infrastructure officer for the 18th Engineer Brigade and the Deputy Chief of Staff, Engineers, U.S. Army Europe. During the deployment to Turkey, she acted as chief of the administrative/logistics operations center. Recent assignments included Deputy Secretary of the General Staff, V Corps, and executive officer, 130th Engineer Brigade.

Lieutenant Colonel Fofi is the deputy brigade commander, 130th Engineer Brigade, V Corps, in Iraq. He was the G3 of the 18th Engineer Brigade for the deployment to Turkey. Previous assignments include commander of the 46th Engineer Battalion (Combat)(Heavy), Fort Polk, Louisiana; liaison officer to the French Engineer School in Angers, France; and brigade S3, 45th Area Support Group, and battalion executive officer of the 84th Engineer Battalion (Combat)(Heavy), both in Hawaii.

Lieutenant Colonel McClellan is the G3, 18th Engineer Brigade (Theater Army). During the operation, he served as the brigade's operations officer, working directly out of the ARFOR–T Main in Mardin. Previous assignments include contingency operations officer (SFOR/KFOR) for Deputy Chief of Staff, Engineers, USAREUR; as well as S3, 9th Engineer Battalion, and director of public works in Schweinfurt, Germany.

Major McGinley is the chief of operations, Staff Engineer Section, V Corps, in Iraq. He was the chief of plans, G3, 18th Engineer Brigade, for the deployment to Turkey. Other assignments include brigade S3, 1st Infantry Division Engineer Brigade, executive officer of the 9th Engineer Battalion, and assistant division engineer, 1st Infantry Division. He will take command of the 54th Engineer Battalion in summer 2004.

Letters To The Editor

A Letter From Iraq

To the MANSCEN Directorate of Training Development,

I really appreciate the box of treats that the people at DOTD sent to me. It meant a lot, knowing there were people who cared enough to do that. The time I spent at DOTD and the MANSCEN was rewarding, and I met a lot of good, dedicated people. I'm proud and thankful that I have been given the opportunity to deploy and do my job as a firefighter. It is a learning experience, and I hope to bring lessons back to use to implement change to our doctrine. My parents taught me that the best lessons learned are those that are learned through hardship. If that is true, this deployment should produce some good lessons learned.

Life here in Kuwait and Iraq is hot, sandy, and windy. It is sad to see the way these people have been forced to live. I know we did the right thing by freeing them. After driving by and seeing what these people have had to endure, it makes me angry when one of our own people complains. We have no reason to ever complain, and I'm proud to be here helping. Keep up the hard work that you do there at DOTD; it pays off on the battlefield, as I have now seen firsthand.

My fire-fighting unit, the 562d Engineer Detachment (Fire Truck) from Fort Leonard Wood, was on the Iraqi border next to the Paladins and Patriot systems the night the war began. At least three Scuds flew overhead as we ran to our bunkers. Also, a mortar round hit and destroyed a Kuwaiti police station about 1 to 2 kilometers from us. We wore various levels of MOPP gear for 2 months.

We are staying very busy and rarely have access to photos or mail. There are no modern facilities here. It's like living back before running water and electricity. But it's great to experience what it's like not having all the things we take for granted; it shows us a simpler way of life.

Those who really know me know that I could talk on forever, but I will cut it off now. Thanks again for the box of treats; I did share it with my soldiers. They are great guys, just as everyone is there at DOTD. Sorry for the sloppy handwriting; I don't have a table to steady the writing pad.

Sincerely,
SFC William A. Brassfield
June 2003

QA/QC Construction Supervision . . . or "Just Wing It"

As a nonengineer, I read *Engineer* for general interest. Articles that are "engineer-techie" go by me in a hurry, although I do have a civil engineer working for me who can explain—slowly and patiently—what I do not grasp. However, the January-March 2003 issue contained a lot of information at my level.

I was especially impressed by USMC Major Jeffrey J. Johnson's article on QA/QC (page 16). This is a tremendously weak area that needs a lot of work. Major Johnson's credentials for commenting are impeccable—in Joint Task Force 6 (JTF 6), he saw a long string of engineer construction units pass through and knows whereof he speaks. I would reinforce his statements. At Fort Lewis Range Control, we have—over the past few years—tried to avoid doing much range construction with engineer troop units because QA/QC is so bad. We'd rather not get something built than to go through the agony of dealing with shoddy results caused by inadequate (at best) QA/QC.

Some would protest that this is driven by the nature of the missions we can offer. Units working on installation projects are not deployed; they are coming from garrison and are subject to all the distractions of garrison life. But in the past, I have seen engineer units accomplish great construction planning, execution, and QA/QC on our projects under those identical conditions. It is definitely in the realm of the possible, but it has to happen by intent, skill, and application—not by osmosis. I also note that Major Johnson's comments apply entirely to units that are deployed to JTF 6 and away from garrison, so it's obvious that it's a problem more of organization than of location.

Bottom line: There is a crying, critical need for applied QA/QC in engineer troop project planning and execution.

John Weller
Fort Lewis Range Officer

Improving the Engineer Battalion's Combat Power:

Lessons Learned in Iraq

U.S. Army photo by SPC Derek Gaines

By Captain Aaron P. Magan

The 326th Engineer Battalion (Combat)(Air Assault), based at Fort Campbell, Kentucky, is a part of the 101st Airborne Division (Air Assault). On 6 February 2003, the battalion received deployment orders to Mosul, Iraq, in support of Operation Iraqi Freedom. Although the unit accomplished all its assigned missions and suffered no combat losses from a lack of training or resources, its combat power could be far greater. This article examines the successes and challenges of the battalion, based on the current modified table of organization and equipment (MTOE), and offers recommendations as to the direction future equipment fielding plans and training scenarios should take.

Predeployment and Training

With the clarity of hindsight, it is apparent that some of the predeployment preparations and training events were crucial to our success, and others need some refinement. The division conducted a deployment exercise that proved invaluable as it allowed the unit to—

- Verify load plans based on the newly received shipping containers.
- Identify and requisition blocking, bracing, and shoring requirements.
- Sort hazardous material paperwork and packaging.
- Identify and weigh secondary vehicle loads.
- Update deployment equipment lists so that ships and trains could be reserved based on the unit's equipment footprint.

In short, the deployment exercise accurately reflected the complexity of moving an entire unit with all its associated equipment like no combat training center (CTC) rotation or home station field training exercise ever has. In addition, neither CTC nor home station training scenarios accurately reflected the nature of urban combat operations that we experienced in Iraq or the volume of enemy weapons and ammunition caches.

Urban Operations

In urban operations training conducted before deployment, an impregnable position was continually pursued, resulting in a meat-grinder-type of urban operation attack that consumed soldiers at an alarming rate. In actual practice in Iraq, a sniper or enemy position in a building meant that the floor of that building—or more often than not the entire building—was destroyed by a tube-launched, optically tracked, wire-guided (TOW) missile; an AH-64 or OH-58 helicopter; a tank main gun round; a shoulder-launched multipurpose assault weapon-disposable (SMAW-D); or an AT-4 light antitank weapon. It was reassuring to see that commanders did not continue to send soldiers into a faulty urban operations attack as is frequently seen in training.

An exchange training program within the XVIII Airborne Corps should be established between 3d Infantry Division and the 101st Airborne Division where mechanized company teams and light infantry battalions are rotated into each other's home station training scenarios. The CTCs do a better job than home station training at integrating mechanized forces in an urban operations attack.

Explosive Ordnance Disposal

Engineers are masters of the "pop-and-drop" hand-emplaced explosive charges for destroying unexploded ordnance (UXO), ammunition, and equipment in limited quantities. However, when dealing with multiple truckloads of ammunition and equipment, standard methods and techniques do not apply. A poorly constructed shot will only create more problems and scatter the now-sensitized ammunition and explosives over a larger area.

With the manpower limitations of explosive ordnance disposal (EOD) teams, it was not possible for them to inspect and/or destroy every cache, so it fell to the engineers to take over the task. None of the standard engineer courses train engineers to deal with proper destruction of such large caches and, as a result, we have to learn by trial and error. Additionally, engineers are not currently trained in any of the Engineer School courses to identify enemy ammunition and explosives, especially when those items have been involved in fires and engineers are required to recommend which items are safe for removal and which must be destroyed in place.

Engineer units need embedded EOD/UXO experts. Based on our experiences in Iraq, the right number is two per platoon. Possible methods for achieving this goal are a joint training program, an additional skill identifier, a change to the program of instruction in the Engineer School, or a change to the MTOE.

Operation Iraqi Freedom

The actual process of deploying went more smoothly than most expected. The usual inconveniences of delayed planes, trains with the wrong combination of car types, and transloaded ships still occurred. We provided two supercargo personnel to accompany the equipment on the ship and sent two advanced-party personnel to secure accommodations at the destination, but little else could have been done that would benefit the unit during the deployment process.

We recommend that the battalion continue to provide a download, maintenance, and reception command and control node at the seaport of debarkation and possibly expand it to cover the aerial port of debarkation as well. That node requires the battalion executive officer and maintenance officer to be an effective reception, staging, onward-movement, and integration (RSOI) multiplier. When properly resourced, they can track incoming equipment, stage downloaded equipment, organize convoys, manage the driver pool, provide maintenance support, and direct incoming personnel.

Every vehicle needs at least one spare tire, already inflated and mounted on a rim. Upon arrival in theater, the initial convoys were briefed regarding distances, and units were cautioned about desert-specific maintenance problems, such as lubrication and air filters, but road conditions were never specifically mentioned. The combination of poor roads, overloaded vehicles, and the debris of war meant that tires were constantly in short supply. A high-mobility, multipurpose, wheeled vehicle (HMMWV) with a flat tire may get soldiers out of the immediate area, but it will not allow them to continue on a convoy for any distance.

M-220 TOW missile

HMMWV scissor jacks need to be replaced with tower jacks (sometimes called bumper jacks or shepherd's jacks) because the original equipment is inadequate. *A tire patch kit is also invaluable.* The kits are inexpensive and require little training to use, making them ideal for each platoon to carry.

Tow bars should be authorized at a minimum of one per platoon. Our unit purchased tow chains before the deployment for every vehicle because of a shortage of tow bars. While effective and relatively inexpensive, it is not the safest way to tow a vehicle. *Additionally, each squad HMMWV needs a self-recovery winch to allow for independent operations.*

In the town of Al Kifl, Iraqi forces had prepared bridges for demolition. Engineers were called on to render the demolitions safe and remove the explosives from the bridge. While this mission was safely accomplished, *embedded EOD personnel would have been an invaluable asset for this mission.*

The Iraqi town of Karbala presented a different type of urban operation than we were used to encountering. As opposed to a village of 40 personnel, as is found at the CTCs or at home station, we attacked a city of 700,000. There was no outer perimeter wire or antipersonnel minefields that ringed the city. Instead, units moved from the landing zone directly into the city and faced no opposition for the first few blocks. However, once the units were inside the city, they faced sniper fire, rocket-propelled grenade ambushes, and sporadic mortar attacks. Without the typical array of obstacles, engineers fought as infantry during the attack and provided limited mobility support. They encountered no enemy-emplaced explosive obstacles. Coalition dual-purpose, improved conventional munitions (DPICMs) were the most frequently encountered UXO, but they could easily be avoided by dismounted personnel. All roadblocks were hand-emplaced by locals and could be removed by hand to allow mechanized forces to pass through. The primary method of mobility support provided by engineers during this operation was the use of bolt cutters to gain access into buildings and compounds. Explosives were still used initially to create breaches into walls, but it ultimately proved faster to use a tank main gun round to create personnel breaches. Often the greater engineer mission occurred once the unit had gained access to the compound and discovered enemy caches.

The magnitude of the caches that the Iraqis had hidden within their population centers meant that entire battalions had to be diverted to begin removing enemy weapons, ammunition, and equipment from the city of Baghdad in order to create a safe environment for the civilians in the newly liberated city. Again, engineers made recommendations to the maneuver units concerning which items were safe to transport out of the city and which must be destroyed in place. We underestimated the amount of demolitions and, more specifically, the number of initiating systems that would be required. Many of the caches had been involved in fires, rendering them unsafe for removal.

Locals had begun breaking apart shells, throwing down the fused warhead, dumping out the propellant, and taking the brass shell casing to sell on the black market. This produced large piles of highly flammable propellant that took only one spark to set off, thereby cooking off many of the warheads lying around. This occurred time and time again all over Iraq and required more Class V supplies than we could carry to destroy it all. What could be transported was hauled to a consolidated cache collection point by the family of medium tactical vehicle (FMTV) trucks that augmented the engineer platoons, as well as all available cargo trucks from the brigade.

Unit basic loads (UBLs) must be adjusted to reflect a dual command-detonated initiation requirement using modern demolition initiator (MDI) shock tube/cap assemblies only. In an urban environment, or in an area where we do not control the airspace, we cannot afford to have explosives set off with a time fuse. It is often difficult, and sometimes impossible, to block off every avenue of approach within a city that leads to a prepared demolition charge. Should the primary command-detonation initiating system fail, we are forced to wait until the time fuse detonates the charge. In the meantime, aircraft can fly overhead, or civilians can wander too close to the prepared demolition. In the future, both the primary and secondary initiating systems should be command-detonated. We were unprepared for this, and while we did not have any mishaps, we also did not have enough of the command-detonated initiating systems on hand to prepare each charge as we would have liked.

Line engineer companies were tasked with opening routes that had been bombed by the U.S. Air Force, as well as Iraqi engineers. A line engineer company has the organic assets to fill in a crater and/or create a bypass. Engineers can sweep the area for UXO before the repair begins, but the end result is a road that is a combat trail at best. Although adequate for military vehicle traffic, to include heavy equipment transporters loaded with M1 tanks, it was difficult for civilian traffic to navigate these roads or newly created bypasses. The engineer work line described in doctrinal manuals lagged far behind the divisional maneuver units. This resulted in 101st Airborne Division engineers clearing and repairing routes through the sectors of three different divisions.

The diversity of missions given to engineers in stability and support operations surprised most people. Road repair, chemical spill response, unstable structure demolition, river interdiction, cache destruction and transport, UXO destruction, route reconnaissance and classification, and a number of other tasks forced us to consolidate the engineer company under the engineer company commander within the brigade combat team. Platoon leaders remained with their task forces and took at least one squad with them each day to respond to missions in each task force sector. The rest of the company became general support to the brigade and worked on taskings generated by daily Civil-Military Operations Center meetings.

Often, engineers massed efforts on missions that did not necessarily represent what was typically thought of as the engineering main effort but rather supported the overall information operations campaign. This approach seemed to work well for us in the northern Iraqi city of Mosul. We often tackled easy engineering victories (such as reopening a roadway for civilians or clearing UXO from a school yard) even though there were more important roads or UXO fields. This allowed us to get the local civilians on our side and showed them that we were interested in helping them reconstruct their country.

Future Organizational Structure

With a rapid runway repair box and two Bobcat® skid steer tractors per line company, the division could double its runway repair capability and add enormous utility to the line company and subsequently its supported brigade. The division seized several airfields, three of which required repairs. Currently, only the division's light equipment company has the airfield repair matting and other required equipment. With the proper reinforcement, a rapid runway repair box could accommodate the weight of two Bobcats and reduce the haul requirement to only one additional truck and trailer. Engineer line companies already have the rest of the required equipment (dozer and small emplacement excavator [SEE] truck). Another plus for the Bobcat is that it can be augmented with auger bits to provide dismounted survivability positions, a concrete mixer (which has been required several times during operations in Iraq), a pavement breaker, and other hydraulic tools.

Each platoon needs its own dedicated FMTV dump truck. An unmodified engineer squad HMMWV can safely carry an entire squad. However, three more load categories remain that require transport: the MTOE items, the soldiers' rucksacks and "A" and "B" duffel bags, and the Class IV and V UBL. The trailer (another issue) can safely carry one of those three load categories. The rest is then left behind or strapped to the sides or top of the vehicle or trailer. The right answer is for each squad vehicle to transport the troops and the mission-essential MTOE items (troop seats are removed and replaced with equipment boxes bolted into the vehicle) and use the trailer to haul the Class IV and Class V UBL. The remainder of the MTOE items and soldiers' bags can then be transported by the platoon sergeant in the platoon FMTV dump truck. Additionally, the truck could be used to support engineer missions when they are attached to maneuver units.

During operations in Iraq, each platoon required the augmentation of a 5-ton-equivalent truck on a daily basis, because they transported enemy weapons and ammunition caches out of the various liberated cities. The ultimate goal should be to resource an engineer platoon for independent operations with the ability to carry all personnel and equipment in a single internal lift.

Line companies should have two additional dozers for a total of four organic dozers to help provide survivability support in the absence of any augmentation. Typically a line company is augmented with a platoon from the division's habitual corps light equipment engineer company. When this does not happen, the line company's two dozers will work around the clock and still take a minimum of six days to finish digging in the brigade commander's priorities for the entire combat team.

An interim solution would be to purchase the excavator that is available from a U.S. manufacturer in lieu of the winch currently found on the back of our dozers. Such an option would force the commander to choose between providing survivability berms with the dozer blade versus providing dismounted survivability positions with the excavator. However, dismounted positions can still be constructed by hand until the dozer arrives, and the previously requested additional two dozers would free up the assets more quickly. In practice, blade assets are used nonstop at the beginning of operations, but that usage quickly scales back after a unit has been in place for a week or more. After the initial flurry of activity, only occasional sanitation trenches and force protection or road repair missions require blade assets.

A HMMWV-based contact truck should be added to the MTOE. Sapper companies currently have their own maintenance sections based on our own battalion internal reorganization. However, they need a HMMWV contact truck as opposed to the older excess commercial utility cargo vehicle (CUCV) that is currently on hand.

The company is one HMMWV short of what is required. The first sergeant needs a vehicle and so does the assistant brigade engineer. Currently, it is one or the other. *The company also needs to be authorized an operations noncommissioned officer (NCO).* Companies in our battalion currently pull the senior squad leader to fill this role.

A platoon-sized Kipper Tool kit would have greatly enhanced the level of support that engineers could have provided for the maneuver commander. Our unit purchased these tool kits using organizational money; however, they should be MTOE items fielded by the Army. Kipper Tool's base camp construction kit was long overdue, and we used it nonstop in Iraq.

Engineer equipment fielding should be on the same schedule as the supported infantry unit. Currently, engineers are the only habitual slice element that fights dismounted alongside the infantry, yet they are continually left out of the new equipment fielding plans.

We need to maintain a general support engineer team within the headquarters platoon to react to small incidents. There are always brigade-controlled areas such as the brigade support area, brigade TOC, forward area rearming and refueling points, and primary assembly areas where engineers have to go to react to a single UXO incident or provide transport of a few rounds of enemy ammunition. When engineers are consolidated under the engineer company commander, he can dispatch a squad to deal with the smaller engineer missions.

The assault and obstacle (A&O) platoon leader should be made a permanent MTOE position. The line engineer companies have consolidated all engineer blade assets as well as the Volcano mine system into an A&O platoon. In this battalion, each platoon is resourced "out of hide" with a lieutenant as the platoon leader, and the heavy equipment section NCO in charge generally serves as the platoon sergeant. This structure has served us well both in training and in combat. The notion of using the task force or brigade command sergeant major as the synch-dozer never really worked as well as it's briefed. However, with the dig assets under the control of an A&O platoon leader, we have developed a more efficient survivability section that is capable of simultaneous missions.

Summary

The diversity of missions and extended distances at which engineer units have operated during Operation Iraqi Freedom highlight the need for updating the type of training, organizational structure, and equipment fielding plan. Months—not years—is the appropriate timeline for these changes. There is still time to affect the fight in Iraq and improve the capabilities of the deployed units in this ultimate proving ground for engineers.

Captain Magan commanded B Company, 326th Engineer Battalion, 101st Airborne Division (Air Assault), Fort Campbell, Kentucky, at the time this article was written. He previously served as a platoon leader in the 50th Assault Float Bridge Company, 2d Infantry Division, Korea, and company executive officer and battalion S1, 9th Engineer Battalion, 1st Infantry Division, Germany.

Army divers are a relatively unknown element of the Engineer Regiment. However, they perform many important missions around the world, such as underwater search and recovery, port opening and clearing, river reconnaissance, watercraft maintenance, hydrographic surveys, salvage operations, and underwater demolitions. The divers are a part of the U.S. Army Dive Company at Fort Eustis, Virginia. The company has five dive teams, two of which deployed to support Operation Iraqi Freedom. The following excerpts from journals kept by the authors describe a few of the missions they performed.

544TH ENGINEER TEAM (DIVE)

By First Lieutenant Christopher F. West

The 544th arrived in Kuwait on 30 March 2003 and moved north into Baghdad to link up with the 565th Engineer Battalion at Logistics Support Area (LSA) Bushmaster on 4 April.

9-13 April

We received our first mission from the 130th Engineer Brigade to help with the search and recovery of a shot-down F-18 and its pilot. At the crash site, we were notified that a Navy explosive ordnance disposal (EOD) team and a Marine expeditionary force reconnaissance team were also on-site. The Navy EOD team gave us the locations of the plane wreck and where the Air Force pararescuemen, or parajumpers (PJs), had found the pilot's parachute.

Both the 544th and the Marine team performed a hasty search using a side-scan sonar system. (See note on page 31.) We developed a plan and calculated a search area to look for the body of the pilot. We divided the area so the Marines would work from the south and move north and the 544th would do the opposite. When we recognized an object as a potential priority (such as the pilot, ejection seat, parachute, or cockpit), by means of the side-scan sonar system that parallels the shore in an attempt to locate foreign objects, the 544th would dive and verify each of these potential sites. We pulled out smaller wreckage pieces and brought them to shore. After several days of searching, something that looked like a body was spotted from a helicopter. Divers from both the Marines and the 544th verified that it was the pilot, and a medical evacuation aircraft flew the body back to Tallil Air Base. Later, Navy EOD personnel destroyed the F-18 using C-4, and the 544th disposed of the wreckage it had brought to shore.

Soldiers from the 544th Engineer Team (Dive) move out across the water to conduct a hydrographic survey for an upcoming river-crossing mission.

14 April

The 814th Engineer Company tasked the 544th to link up with the 565th Engineer Battalion to conduct a deliberate river reconnaissance of a potential assault bridge site at Objective Peach. A seven-man element collected shore and water data and took digital pictures of the near and far shores. The end state was a hydrographic survey with DA Form 7398, *River Reconnaissance Report*, and digital photos attached to it.

18 April

The 544th received a mission from the 565th Engineer Battalion to help the 101st Airborne Division recover sensitive items dropped in a canal north of the Karbala Gap. Eight soldiers had fallen into the 30-foot-deep water, following a light medium tactical vehicle (LMTV) crash, and had lost sensitive items. Surface swimmers looked for these objects, but after recovering only four weapons and a Kevlar® suit during the first hour, the team decided to put scuba divers in the water. By the end of the diving day, we had recovered equipment totaling more than $100,000.

23 April

A six-man reconnaissance team traveled with the 565th Engineer Battalion to Tikrit to conduct hydrographic surveys of the largest-ever military river-crossing site. While in Tikrit, the 544th pulled debris out of the work area for the bridge companies and helped the 74th Engineer Team (Dive) render hydrographic surveys.

27-28 April

A 13-diver team spent two days at Engagement Area Chamberlain, cutting four steel I beams with the underwater torch. The team also conducted salvage operations on the new pontoons emplaced by the 671st Engineer Company. A hole in one of the pontoons caused it to sink, and the weight of the sunken pontoon forced another pontoon to sink also. The 671st developed a patch that could be used on the pontoons so they could pump out the water. Once the pontoons were floating, the divers plugged the hole in the one pontoon with a bolt. The entire area was cleared to allow bridging to continue.

4 May

Divers from the 544th met with Iraqi water treatment plant workers to determine the location of potential sea mines to the east of the bridge at Objective Peach. The workers, who spoke fluent English, believed that there were 40- to 500-pound sea mines on the shore but that there were none in the water. The divers used the side-scan sonar to search the area but did not find any mines.

4-9 May

Six divers supported the LSA Anaconda EOD team responsible for ridding the base of all unexploded ordnance (UXO) and munitions. The mission included lifting, moving, and hauling crates of ammunition to bunkers to completely backfill them.

8-12 May

The 544th began pumping water out of the canal just outside the fence of LSA Anaconda to help the 864th Engineer Battalion fill holes in the airfield with concrete and extend the landing strip. The divers were on call 24 hours a day to support this effort and used their new 180-gallons-per-minute pumps to conduct the mission. The trucks needed to be filled an average of six times a day to satisfy the requirement for concrete.

The 544th was tasked to find an area for conducting dive training in the vicinity of LSA Anaconda. A lake in AdDuval was only 15 kilometers away and seemed fairly large, so a team of divers went to determine the feasibility of diving and helocasting operations there. Upon arrival, the divers noticed a large cache of used, unused, unexploded, and exploded ordnance and munitions, which indicated that this was not a good place to dive. However, the team completed a hydrographic survey and determined the average depth of the water to be about 8 feet.

First Lieutenant West is the leader of the 544th Engineer Team (Dive) at Fort Eustis, Virginia. He is a graduate of the United States Military Academy.

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74TH ENGINEER TEAM (DIVE)

By First Lieutenant P.J. Inskeep

After arriving in Kuwait on 14 April 2003, the 74th Engineer Team (Dive) met up with the 5th Engineer Battalion on 18 April at the Taji Airfield on the north side of Baghdad.

22-26 April

The team was notified of a river reconnaissance mission on the Tigris River in the vicinity of the city of Tikrit. Two members of the team convoyed to Tikrit with the command element of the 74th Engineer Company (Assault Float Bridge[AFB]), where they linked up with personnel from the 130th Engineer Brigade and the 299th Engineer Battalion and a reconnaissance team from the 814th Engineer Company (AFB). The initial assessment of the damage that two 500-pound bombs had created was that the bridge was blown in two different places, causing obvious structural damage. The current was so strong that we wondered if we could even get a diver down to the bottom. We took the initial data back to the 299th's tactical operations center (TOC), where the commander of the 130th began to devise a plan to fix the bridge. The 74th Engineer Company commander called back to Taji Airfield to prepare the rest of the team for a convoy to Tikrit.

Divers transport gear from the shore to the bridge site where diving is taking place.

Divers emplace detonation cord in preparation for clearing underwater obstacles.

A topographic detachment at 1st Brigade, 4th Infantry Division, headquarters provided the imagery we needed to complete a hydrographic survey. Back at the site, we collected near-shore and far-shore data using our Trimble TSC1™ data collector and took photographs to analyze the best method for clearing a lane for the bridge.

Using the side-scan sonar, we conducted a survey of the bottom of the river. We could see that there were no major obstacles in the middle of the river, but there were about 20 large trees and numerous small bushes in the way of the projected path of the bridge on the far shore. Also, there were two I beams under the surface of the water on the near shore where the bridge boats were being launched. The other boat left to conduct a hydrographic survey of the bridge site using the Global Positioning System (GPS), a high-precision depth finder, and Trimble software to collect the river depth data. After all the data was collected, we rendered the survey for the bridge companies using Terramodel™ software.

Divers from the 74th Engineer Team (Dive) stand on the shore as they watch a bridge blow after a demolition emplacement mission.

Meanwhile, other divers set up a surface-supplied station, which consisted of SuperLite (SL) 17K helmets, a communications box, air supply hoses, and a high-/low-pressure air system. Then, we inspected everything beneath the water and measured the diameters of the trees at their base to start a demolitions plan. We found the water to be about 10 feet at the deepest spot. After assessing the situation, we decided to let surface swimmers measure the diameters of the trees off of breath holds.

While this was taking place on the far shore, we conducted a reconnaissance of the two I beams under the surface by measuring the beams that were above the water's surface. From this, we developed a demolitions plan. We received permission from higher headquarters to set off the demolitions the next morning. One group was to remove the trees from the far shore and another would remove the two I beams. They rehearsed and planned three separate shots.

Two divers in scuba gear placed the charges. The divers had zero visibility in the water and were working against a strong current. The only sense they could use to emplace the demolitions was touch. Each diver emplaced the demolitions on the downstream side of the tree. The demolitions were then held in place by 550 cord (parachute cord), and we had detonation cord already attached to the charge and precut to 15 feet.

Once the demolitions were set, the detonation cord was tied to the tree above the water until the charges were correctly placed. Then surface swimmers ran a ring main to all the charges and tied them in, and we connected the modern detonation initiator (MDI) and ran it to the far shore for detonation. At the same time, we made sure the military police had cleared the bridge. After our first blast went off successfully, we emplaced the next round of charges and set up shearing charges to cut some I beams that had ruined the hull of a bridge boat the day before. The two sites blew simultaneously. The third blast was a single tree. Once the water was cleared, we helped pull the trees out.

27 April

The bridge companies wanted us to blow the rest of the little brush and cut out five light poles. We performed a reconnaissance, came up with a plan, and prepped the demolitions for it. The demolitions had to be in early that day so the bridge companies could rehearse their operations, so we emplaced them and by 0700 were prepared to blow.

One of the divers took on the task of removing the five poles. Having dived in fast current before, he thought it would be best to see if demolitions could be placed at the base of the poles to ensure that they were sheered completely and no longer posed a navigational hazard to the bridge boat operation. A diver went in the water off the Zodiac® inflatable boat moored to a pole. The current was too strong to even get to the pole safely. The diver tried to slide the demolitions down the pole from the boat. However, weeds and brush had been pinned to the pole by the current, which prevented the demolitions from sliding to the base. We decided to try to put another diver in on the pole so he could shimmy down it. Again the current was too strong, and he could not reach the bottom.

We finally decided to cut the poles about 3 feet above the water and see if they were hollow. If they were, we could pack C-4 inside them and remove them with no problem. We took out a boat that a mechanic with the 74th had repaired—one that had belonged to Saddam. (We didn't think he would mind if we borrowed it to help his people!) On the boat, we set up an oxyacetylene cutter, and another boat was set up to pull the light pole away from the cutting boat so no one would get hurt. Once the poles were cut, we discovered they were hollow. We put charges inside each one, packed them with dirt and water, and blew them that night. The poles were removed, and the site was ready for the bridge.

28 April

Bridge construction began. We had a boat upstream and another downstream from the bridge, searching for enemies on the water. We also had an emergency surface swimmer ready in case anyone fell in the water and a scuba diving station set up as a quick-reaction force. The team searched the river, reporting every half hour. They spotted a couple of fishermen, but nothing serious. By 1300, the bridge was completed and we were pulling security up- and downstream from it. We did it during the daytime, and the infantry took over at night.

6-8 May

We conducted our final day of reconnaissance for the destruction of the two Tikrit Bridge spans. One diver rappelled underneath the bridge to estimate what needed to be done. After receiving the demolitions from the 814th and 502d Engineer Companies, some of us were assigned to the near-shore span and the others the far shore. In emplacing the demolitions, our only problem was how to attach them to the bridge without causing further damage to the spans. The first explosion was a success; each span fell as we expected and no further damage was done to the bridge. We cleared the bridge and prepared demolitions to destroy the near shore span. When we set off the demolitions, the span was destroyed and the 38th Engineer Company (Medium Girder Bridge) began to emplace the Mabey-Johnson bridge.

9-11 May

A Black Hawk had crashed into the Tigris River near Samarra, and we searched for sensitive items. The divers also searched inside the helicopter for personal items of the pilots. Unfortunately, we discovered that all four men had died. (Their Kevlar suits were used the next morning for a memorial ceremony.) Later, we rigged up the helicopter to a crane and pulled it out of the water. We gathered all the bits and pieces that floated downstream and collected the data needed for a hydrographic survey.

14-15 May

We cut down I beams that were in the water so the 38th could use them for the Mabey-Johnson bridge. The men set up a surface-supplied station, brought out the hydraulic cutter, and went to work. The water was only 10 feet deep, but they could only see inches in front of their eyes. The small amount of oxygen on hand meant they could only cut down one I beam each day.

20 May

We found another lake within the compound. The divers located weapons and ammunition, which were taken to Tikrit North Airfield and disposed of.

First Lieutenant Inskeep is the leader of the 74th Engineer Team (Dive) at Fort Eustis, Virginia. He is a graduate of the United States Military Academy.

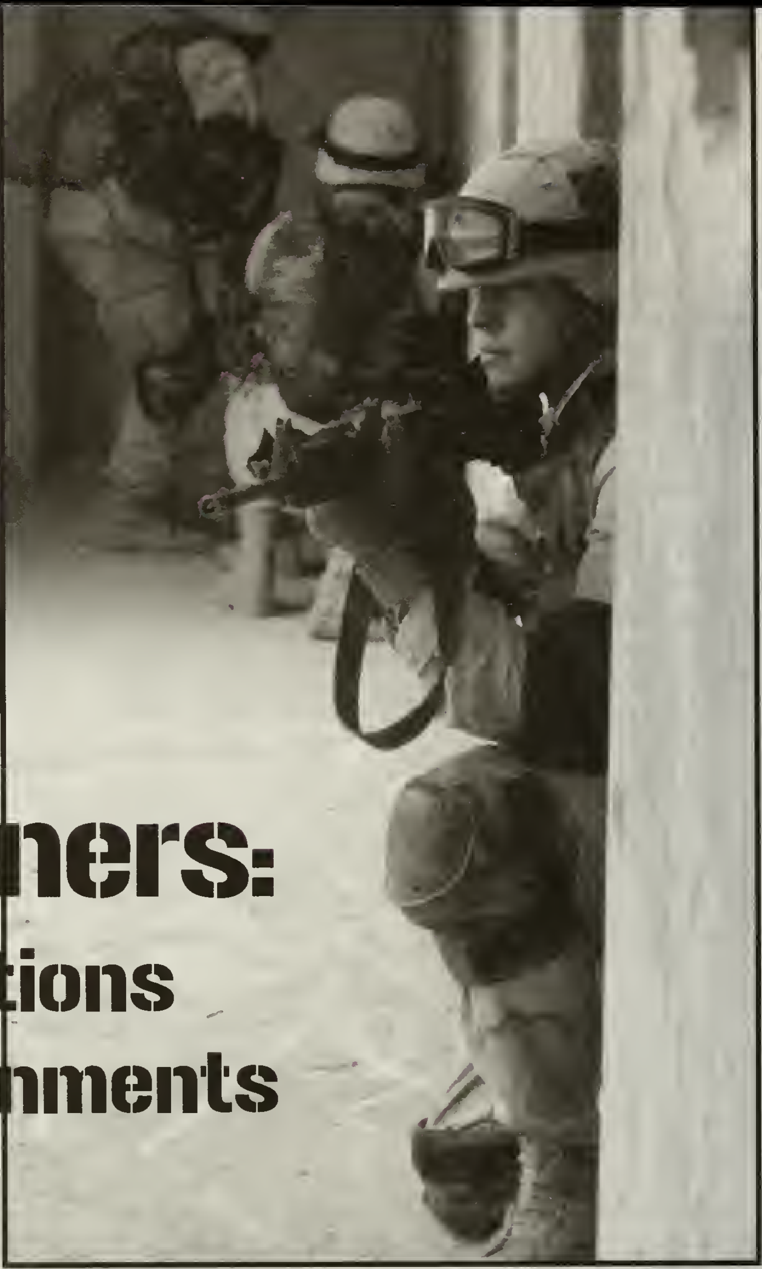
* * *

Both the 544th and the 74th Engineer Teams (Dive) continue to perform their unique missions in the barren regions of Iraq. In spite of the frustrations, the soldiers are experiencing satisfaction from a job well done and knowing that they are contributing to the very important Operation Enduring Freedom.

Note: *The side-scan sonar is a method of underwater imaging that uses sound rather than light. The system consists of a processing unit above water, a cable for towing and electronic transmitting, and a unit beneath the surface (a towfish) that transmits and receives acoustic energy (sound) for imaging. The system was originally designed for ocean archeology, but its military application was recognized early on. The towfish, which looks like a 4-foot torpedo, contains a transducer and receiver that exchange signals within nanoseconds, using the speed of the boat and a GPS to create a picture on the attached computer. While the towfish is being pulled behind the boat, the transducer on either side of the towfish generates a half-inch sound signal. What is actually seen on the screen is sound waves bouncing off objects and creating shadows. The side-scan sonar, which is best used to find large objects, has made river reconnaissance quicker and safer, as well as making searches in larger bodies of water more accurate and more efficient.*

Breaching Around Corners:

Engineer Operations in Urban Environments



By Lieutenant Colonel Anthony C. Funkhouser

The Department of Defense and the Army recently published new strategic-, operational-, and tactical-level doctrine for urban operations: Joint Publication 3-06, *Doctrine for Joint Urban Operations*; Field Manual (FM) 3-06 (Doctrine Review and Approval Group [DRAG]), *Urban Operations*; and FM 3-06.11, *Combined Arms Operations in Urban Terrain*. The Army has long published doctrine on military operations on urbanized terrain (MOUT), but the previous doctrine was typically constrained to tactics, techniques, and procedures at the brigade level and below. The doctrine was flexible and allowed commanders the option to enter a city or isolate it and bypass. Due to the complex nature of urban operations, commanders typically opted to isolate and bypass. However, this may no longer be a solution. We now face adversaries that use asymmetric tactics and/or terrorism because there are few who can directly oppose America's combat capabilities. Future threats may use cities to negate our technological advantage and use the civilian population to impede and complicate operations. Commanders may enter cities to pursue the threat or to seize intermediate objectives. For this reason, it is imperative that engineers understand the potential problems under all these circumstances.

The newly published doctrine provides a new urban operational framework—*assess*, *shape*, *dominate*, and *transition*. This provides a means for the commander to frame how he visualizes, describes, and directs the urban fight. The two new Army manuals provide limited considerations for engineer missions. Many of our maneuver peers, and even engineers, think of engineer operations as solely limited to combat operations (mobility/countermobility/survivability). However, at the operational and tactical levels, engineers provide significant contributions from the geospatial and general engineering functions. The following paragraphs describe some additional battle command considerations for engineer operations in urban terrain. This article examines the *assess* portion of the urban framework as a primer to stimulate thought.

Engineers in MOUT

As the commander frames the urban fight, he begins with an assessment of the terrain, the threat, and friendly capabilities.

See the Terrain

The complexity of urban terrain demands map products that provide a common operational picture for the commander to visualize the urban three-dimensional terrain. The National Imagery and Mapping Agency, Alexandria, Virginia, produces urban terrain imagery. There are a number of commercial off-the-shelf software products like FalconView™ and Tactical Operational Scene (TopScene™) that use satellite imagery and allow a fly-through capability. However, these products do not provide detailed infrastructure information such as utilities, sewer systems, and bridges. This important information that maneuver commanders need to make informed decisions can be accessed through the U.S. Army Corps of Engineers Topographic Engineering Center, Alexandria, Virginia, which has developed an Urban Tactical Planner software program intended to support MOUT. It is a compact, field-ready suite of urban terrain data and geospatial analysis tools. These tools facilitate rapid visualization of key aspects of the urban environment, including buildings, roads, railroads, streams, forests, marshes, water bodies, and vertical obstructions. It uses streamlined data sets to provide the greatest amount of data in a small, easy-to-use package. The product is designed to be produced on short timelines to meet contingency planning requirements as they arise. Urban Tactical Planner provides an overview of the urban terrain in the form of maps, imagery, elevation data, perspective views, handheld photography, video clips, scanned building plans, tables, and text. The data is structured for use with ArcView® 3.0a Geospatial Information System (GIS) software—the most common commercial off-the-shelf desktop GIS. ArcView 3.0a, the basic software used by the Army's Digital Terrain Support Systems, allows terrain teams to manipulate data and apply unit-specific control measures. The Topographic Engineering Center provides databases for many cities on its Secret Internet Protocol Router Network (SIPRNET) Web site at <*tec.smil.mil.*>

Soldiers operate in the confined space of a MOUT environment.

"Engineers enable maneuver commanders freedom of maneuver within the urban environment to accomplish their mission."

See the Enemy

As we examine the threat in the urban environment, we know that no matter how a threat fights (whether from house to house or in concentric circles or concentric circles with strong points), the maneuver commander will face the challenges of moving through a dynamic environment filled with complex obstacles. Urban obstacles may include existing debris, furniture, vehicles, wire, and rubble. These alone hinder the maneuver of units but are complicated with the movement of civilians throughout. Civilians can be considered dynamic impediments to maneuver and must be influenced away from the route. To complicate matters even further, the threat may introduce mines and other improvised explosive devices (IEDs). No longer in a two-dimensional plane, mines not only may be placed under roads but also may be positioned for a side or top attack mode that is command detonated or activated. Antipersonnel (AP) mines, IEDs, and booby traps may also be used in many areas, buildings, and other likely avenues of approach.

Recent urban combat experiences in Northern Ireland, Grozny, Jenin, and Afghanistan reveal an accelerated adaptation to countermeasures developed by friendly forces. The threat will also adapt and use IEDs to complicate our detection and neutralization efforts. Examples of recent IEDs found around the world include remote detonation devices using electronics, radio control, or even cellular telephones to initiate the systems. These methods are all shared via the Internet. So what British Forces encounter in Northern Ireland may soon confront our soldiers in another urban area of operations. Some current IED techniques are as follows:

Coupling. One mine or explosive is linked to another, usually with a detonating cord. When the first device is detonated, it detonates the linked explosive. This technique is often used to defeat countermine equipment such as mine rollers. When the linked devices are directional fragmentation mines, they can create a large, lethal engagement area.

Boosting. Buried low-metal mines are stacked atop one another, and the farthest mine from the surface is fuzed. This reduces the probability of detection and increases the force of the blast.

Sensitizing. This technique is used with antitank (AT) mines. On some nonmetallic AT mines, the pressure plate can be cracked and the spring removed to reduce the pressure required to initiate the mine. Similarly, the pressure plate can be removed from metallic AT mines for the same effect. Alternatively, a pressure-fuzed AP mine can be placed atop an AT mine thus creating a very large AP mine.

Daisy-Chaining. Command-detonated AP mines are commonly used in daisy chaining. Enemy forces link the mines with trip wires or detonating cord. When the initial mine is detonated, the other mines will detonate. This creates a large, lethal engagement area.

The threat will also take advantage of survivability within the urban environment by digging in open areas and using existing infrastructure to conceal positions. We can expect the threat to maintain mobility between positions to interdict friendly lines of communication and to reinforce his own positions. FM 3-06 (DRAG) highlights that historically, the threat will resist his own isolation more than any other friendly effort. Since we can never achieve a 100 percent isolation, the resulting movements impact on potential future maneuver operations.

Another key to understanding an urban environment is assessing the threat's general engineering capabilities. Adversaries have general engineering capabilities in their own forces or host nation to maintain utilities and infrastructure. They have access to commercial equipment and experts to repair destroyed targets. As friendly forces target and destroy utilities or reduce their capabilities, the threat may dispatch its own forces to rapidly repair or improvise a means to maintain the capabilities we are attempting to eliminate.

See Yourself

We will seek to maintain freedom of friendly maneuver and deny threat movement throughout the urban terrain. Engineers enable maneuver commanders freedom of maneuver within the urban environment to accomplish their mission. The fundamentals for success will be our ability to—

- Predict actions and circumstances that could affect maneuver.
- Detect using early indicators of impediments.
- Act early to prevent potential impediments from affecting maneuver.
- Avoid impediments by identifying alternate routes.
- Neutralize by reducing or overcoming impediments.
- Protect the force against the effects of threat and impediments.

Friendly capabilities vary by unit. What friendly assets allow us to achieve these fundamentals? Prediction capabilities include all the intelligence, surveillance, and reconnaissance capabilities within the organization but may be dependent on human intelligence. Current detection capabilities are limited for operations within the urban terrain. Capabilities include dozers with mine-clearing armor protection, robotics such as the Matilda, the Improved Vehicle-Mounted Mine-Detection System (IVMMDS), sappers with mine detectors such as the AN/PSS-12 or Handheld Standoff Mine-Detection System (HSTAMIDS), and coalition and/or contracted mine dogs.

Mines and booby traps are never more difficult to detect than after they are emplaced; that is why prediction and interdiction or prevention are so important. These detection assets are extremely limited within the engineer inventory, and operations within multiple or major urban areas will exhaust detection capabilities quickly. Detection training will need to occur before deployment as well as in theater to train on the adaptive enemy's techniques.

Neutralization capabilities include mine-clearing line charges (MICLICs), Panthers, plows/rollers, mine flail systems, the Antipersonnel Obstacle Breaching System (APOBS), launched grapnel hooks, explosive ordnance disposal (EOD), specialized equipment and training (sets, kits, and outfits), ladders/bolt cutters/rescue saws, and contract support for additional capabilities. None of these systems by themselves can do it all, but good engineers will determine what combinations of resources are available to accomplish the mission. The combat engineer vehicle (CEV) no longer provides rubble removal under armor. It is questionable whether the M9 armored combat earthmover (ACE) has the mass and traction to push rubble. Therefore, we need to explore other options. In Jenin, the armored D9 dozer has proved its worth in the urban fight. However, if it is not available, could we integrate an M88 recovery vehicle forward to lift vehicles out of our way when a blade vehicle may not have room to displace the rubble or other material?

Also, how do we work with EOD units forward and leverage their capabilities to identify, render safe, and dispose of unexploded ordnance (UXO) and IEDs to minimize collateral damage? Engineers must work with EOD personnel early in the planning phase to organize and delineate responsibilities for the execution of mobility operations. Potential operations may have engineers detecting, marking, and bypassing IEDs, allowing EOD personnel to render them safe and minimize harm to civilians in the area. Civilians will be a significant issue for our forces. They may not move to relocation areas and will be intermingled with our adversaries throughout the areas of operation. So what assets are available to move civilians from potential maneuver routes?

Nonlethal weapons may also provide an option to the commander, depending on the situation. There are a number of systems available that the military police have proponency for. (For more information, see *Military Police, The Professional Bulletin of the Military Police Corps,* April 2003). Therefore, engineers will have to work closely with the military police as we develop courses of action to deal with civilians along our routes.

Other Considerations

Other friendly force considerations include providing force protection, solving logistical issues, minimizing collateral damage, and accessing expertise to remote areas.

Force Protection. A major concern for all commanders is force protection of all these unique capabilities. In a three-dimensional environment, a unit's flank is always exposed to a potential threat. Therefore, as we maneuver through the urban environment, engineers need to simultaneously conduct countermobility operations to protect the flanks within a compressed area of operations. Protection of engineers will be vital as they are exposed to a wide range of IEDs. Concurrent training for engineers and maneuver forces on the most recently identified threat capabilities in the area of operations will improve protection of engineers and the combined arms team. Another lesson learned from Jenin and Grozny is the removal of all flammable materials from the outside of combat vehicles. Urban forces should consider increasing their requirements for fire extinguishers as the potential for fire increases in the urban area.

Logistics. Historically, certain key classes of supplies are consumed at a higher rate in urban operations—as much as five to ten times normal consumption rates. As a result, friendly forces can anticipate an increased logistical requirement for hauling supplies for urban operations and moving critical engineer assets. Since engineers tend to use large items for barriers in isolation operations, acquiring dedicated assets may become a problem. Engineers will have to be resourceful and use existing materials in the urban area to their advantage. It may require "urban foraging," which can range from contracting materials to confiscation. Engineers should conduct a thorough assessment of the urban area to identify potential locations for engineer equipment and materials to reduce haul requirements.

Collateral Damage. Collateral damage alters the urban landscape and may harm civilians. It may also impede movement along previously cleared routes and affect civilian behavior and movement. Therefore, engineers—as the terrain experts—should anticipate where collateral damage may occur and predict the impact on future operations. This engineer battlefield assessment capability may have direct influence on priority intelligence requirements and the entire force. This is no easy feat, but it is one that engineers will be expected to perform.

The Engineer Research and Development Center, Vicksburg, Mississippi, has a new software program called the Simplified Survivability Assessment that captures information and technical data from Technical Manual (TM) 5-855-1, *Design and Analysis of Hardened Structures to Conventional Weapons Effects.* The software allows users to calculate the potential damage created by various weapons on a variety of structures, estimates the protection required against various weapons, calculates overhead cover, and includes a survivability timeline program.

Friendly Capabilities. When assessing our friendly capabilities, we must examine our general engineering capabilities and requirements. General engineering will occur throughout the urban fight and may be the main effort during stability and support operations. As General Krulak, United States Marine Corps, said, "In one moment in time, our service members will be feeding and clothing displaced refugees—providing humanitarian assistance. In the next moment, they will be holding two warring tribes apart—conducting peacekeeping operations. Finally, they will be fighting a highly lethal midintensity battle. All on the same day, all within three city blocks. It will be what we call the three-block war."

We cannot expect civilians to leave cities. They will remain in their homes, and their requirement for services such as food, shelter, water, and medical treatment may outstrip our capability to provide. Therefore, we may be responsible for requirements such as sewage, electricity, and public order. Many engineer units located at echelons above corps, such as engineer commands, may be available to provide specialized capabilities and assist in these missions. If construction engineers and civil affairs personnel are not available immediately after combat operations, then units and combat engineers must initiate general engineering operations for stability or support operations.

Another general engineering capability available to the operational commander is field force engineering—a reach capability by deployed forces to the engineer commands, the U.S. Army Corps of Engineers, and even the Engineer School for virtual collaboration. This allows access to services and technical expertise to these geographically dispersed units in the field.

Summary

As you can see, many engineer requirements have second- and third-order repercussions that the commander must think through. The same process for the engineer battlefield assessment and military decision-making process applies to urban operations, but now we need to consider how the new threat will fight and what new capabilities we have. When the mission finally concludes, engineers must be prepared to transfer functions and responsibilities from military to civil authority or to another agency. This article provides a means to begin thinking through the urban fight and how engineers will make their contributions.

Lieutenant Colonel Funkhouser commands the 5th Engineer Battalion in Iraq. Previous assignments include Chief, Doctrine Development Division, U.S. Army Engineer School, Fort Leonard Wood, Missouri. In that capacity, he spent three months with the Battle Command Training Program-Operations Group F, specializing in urban operations. He also participated in the United States-Israeli Urban Operations Work Group in Tel Aviv, Israel.

Photos by SGT Kevin Doheny, 19th Public Affairs Detachment

36th Engineer Group Conducts Somber Mission

By Captain Brian Chapuran

The soldiers of the design management section of the 36th Engineer Group from Fort Benning, Georgia, are often tasked to survey sites. It is a mission they have done hundreds of times in preparation for various construction missions. The mission they executed on 19 May 2003, however, was anything but normal. Two surveyors and a civil engineer had the somber mission of siting and marking a gravesite. It was the location where Iraqi captors had buried nine U.S. soldiers, members of the 507th Maintenance Company who were captured when their convoy was ambushed. Almost every American has heard the story of Private First Class Jessica Lynch and her dramatic rescue from the hospital in An Nasariyah. The nine soldiers were with Private First Class Lynch when they were captured, but they were not as fortunate as she. The soldiers were killed and their bodies buried in a shallow grave just outside the hospital.

After the bodies were discovered, detailed information about the site needed to be recorded. At this point, the 36th Engineer Group was asked to provide its technical expertise. There were two main reasons to locate and mark the site. The first was to begin the process of designing and possibly building a memorial to the soldiers. The second reason for the mission was to assist in the investigation of war crimes. The information gathered by the 36th Engineer Group will be used by the U.S. Army Criminal Investigation Command as part of its investigation into potential war crimes committed by the former Iraqi regime.

The 36th Engineer Group commander saw the mission as a necessary and unforgettable task in the aftermath of war, yet one more reminder of the ultimate price some have paid to ensure that the principles of freedom are made available to all people. The soldiers from the 36th Engineer Group were proud to put their skills and expertise to use for a mission they probably never envisioned and will never forget.

Captain Chapuran is currently the trial counsel for the 36th Engineer Group and the 11th Infantry Regiment at Fort Benning, Georgia. During Operation Iraqi Freedom, he served as judge advocate, public affairs, and civil affairs officer for the 36th Engineer Group.

Transforming the Light Equipment Company

By Captain Paul J. Kremer

The engineer company, light equipment, is undoubtedly one of the most versatile units in the Corps of Engineers. The variety of missions the company can accomplish epitomizes the resourcefulness of the entire engineer force. While exceptional in capability, the light equipment company must look to the future to ensure that it continues to meet the maneuver commander's needs. Through evaluation of the training in preparation for deployment to support Operation Iraqi Freedom, and the performance of the unit in theater, we in the 887th Engineer Company (Light Equipment) (Air Assault), Fort Campbell, Kentucky, have developed recommendations for the light equipment company of the future. We believe that a new modified table of organization and equipment (MTOE) should be developed, since the last complete revision was in 1983, so the light equipment company of the future will be an even more versatile asset for the Army.

Definition

The MTOE defines a light equipment company as a unit designed to augment a light engineer force. Additionally, one of the main missions of the 887th Engineer Company and the 618th Engineer Company (Light Equipment) (Airborne), Fort Bragg, North Carolina, is airfield damage repair (ADR). Both units repair airfields for the XVIII Airborne Corps. One of the companies has been attached to the 82d Airborne Division and one to the 101st Airborne Division (Assault) since 1986.

Equipment

When looking at the company motor pool, the light equipment company could be defined as a horizontal construction company with equipment that is downsized from that of a combat heavy company. For example, the light equipment company has 613B versus 621 scrapers, 5-ton versus 20-ton dump trucks, and 2.5-cubic-yard versus 5-cubic-yard loaders. The company is a construction asset that can quickly augment a light division with all the main supply route (MSR) construction/repair assets it needs—in addition to being able to quickly "open the door" for a rapid deployment force by repairing airfields for follow-on forces to flow into a forward operating base.

Training

Training is without question the key to success in combat. In preparation for the deployment to Iraq, the 887th focused on two main areas in the 6 months prior to receiving the deployment order: training on the mission-essential task list (METL) and training on the actual task of deploying.

Mission-Essential Task List

Quality time spent practicing the unit's METL is invaluable because it is what keeps soldiers alive as they accomplish missions. The 887th was able to deploy as trained (T) in seven of its eight tasks. The unit trained almost year-round since it does not have a habitual association with a maneuver brigade and therefore does not repeatedly enter into a "tasking" cycle. In addition, enlightened leaders tasked the 887th to work construction projects for the post instead of performing nonengineer tasks. Each year, the countless post projects the unit completed ensured that operators refined their skills. From the METL, there were some tasks that proved essential for combat.

Convoy Live Fire. In the 12 months before deployment, the 887th conducted four convoy live-fire exercises. Each platoon conducted one of these 24-hour events that incorporated a dry blank live fire, day and night sequence of events. As additional challenges for the convoy commander, the exercises also included OH-58D helicopter support—a real-time 9-line request for medical evacuation using the post's UH-60s; nuclear, biological, and chemical scenarios; and vehicle breakdown scenarios. The leadership was fully tested under constantly changing conditions with live ammunition during both daylight and darkness. The leadership training was crucial to our future success in Operation Iraqi Freedom. Little did we know that we would be convoying more than 1,100 kilometers along future MSRs in Iraq. Since every mission required convoying to the mission site, this training was validated on a daily basis.

Airfield Damage Repair. The task the unit wanted to be absolutely 100 percent prepared for was ADR. In the year before deployment, 3d Platoon spent 6 months in Kandahar, Afghanistan, making daily repairs to the airstrip. The hands-on experience made them ADR experts. To ensure that the rest of the company also achieved the highest training levels, the company planned three ADR exercises off post. Over the course of 5 months, the 887th sent platoons to Malmstrom Air Force Base, Great Falls, Montana, to train with the 819th RED HORSE; Fort Bragg, North Carolina, to train with the 20th Engineer Brigade; and Germany to train with the Southern European Task Force. Training with rapid deployment engineers from both the Army and Air Force allowed the 887th to display its skills on ADR as well as watch the other units perform their battle drills. Once the training was completed, the 887th knew it had the best-trained and most experienced ADR experts in the armed forces.

Combat Lifesaving. Combat lifesaver training should be required of every company on a quarterly basis. For the 887th, the week-long training proved its worth. The company suffered several injuries over the course of 2 weeks during Operation Iraqi Freedom, including cutoff fingers; an unexploded ordnance explosion causing shrapnel wounds and lost toes; and an enemy grenade attack on a stopped vehicle, which caused extensive shrapnel wounds to a soldier. But amazingly,

Soldiers from the 887th Engineer Company use a small emplacement excavator (SEE) and a Bobcat® to repair a crater in an airfield in northern Iraq.

not a single soldier was killed during these incidents. Combat lifesavers were on the scene in each instance, and without question they saved lives. It was difficult to have soldiers injured, but it would have been tragic for them to die.

Deployment Exercise

In November 2002, the 887th was directed to conduct a deployment exercise, which would become one of our best training events to date. The exercise required that we fully upload and roll everything out of the motor pool; move to a scale house for weigh-in; and have the vehicle secondary loads inspected, which included preparing hazardous material (HAZMAT) paperwork. At the end of the exercise, we would be ready to load the train in preparation for war and have an extremely accurate automated unit equipment list/deployment equipment list.

The 887th spent a week conducting the deployment exercise as the company prepared more than 100 vehicles to move. As the unit left the motor pool, it was simple to verify the accuracy of the non-mission capable (NMC) report—an additional bonus before deployment. As the unit moved through the various stations, it became obvious which HAZMAT teams were best, who packed their secondary loads best, and what load plans needed refining. Having railroad company personnel at the last station to inspect the vehicles was essential to success. They showed us what would not pass their inspection team in the future and helped the unit executive officer replan a few secondary loads. Once the exercise was complete, the company knew how to upload for war and how long it would take, which unit movement officer and HAZMAT teams were best, and that the company master load plan was accurate.

After conducting quality training for 18 months and completing a highly successful deployment exercise, everyone knew we were ready for combat—that we could get to war in a well-planned, well-rehearsed manner and subsequently execute any missions assigned to us once in theater.

Operation Iraqi Freedom

The 887th received the order to move to the rail yard in early February 2003 to began preparations for overseas movement and arrived in theater on 1 March. The company operated over the entire division area of operations, providing the engineer battalion commander the ability to quickly weight any main effort. During the initial assault into Iraq, survivability of forward area rearming and refueling points (FARPs) was key. The 887th assembled all its blade assets and some SEEs to protect them and to dig in command and control nodes. Once in the vicinity of An Najaf, the 101st Airborne Division required survivability support as it reconsolidated. FARPs were constructed, division command and control nodes bermed, borrow pits operated, and Patriot batteries dug in as the 887th received mission after mission.

When the 101st moved to Baghdad, the 887th provided support by clearing 50 kilometers of Highway 8 and 70 kilometers of Highway 1 of all obstacles emplaced by Iraqis and more than 60 vehicle hulks destroyed by the 3d Infantry Division. With the highways cleared, the 4th Infantry Division was able to move into sector along a high-speed MSR during its movement north.

The 101st then began taking successive airfields—Al Iskandariyah, Mosul, Qayyarah West, and finally Tall Afar. The 887th assembled teams for each one, clearing the airfields, sweeping the area for helicopter/Air Force operations, and conducting ADR. As airfield runways were being worked, the 101st also required survivability/force protection support as units closed on those airfields. The 887th again supported that effort. Other missions included hauling rock to projects, clearing airfield hangers, hauling division command post equipment, and constructing/emplacing force protection measures around the base camps.

Future Organization

While the unit was highly successful during Operation Iraqi Freedom, there are always ways to improve. Two problems were obvious after only 2 months overseas: transportation and maintenance.

Transportation

During all phases of Operation Iraqi Freedom, the 887th was required to move very long distances, mostly without additional transportation support. The unit made three moves of 200-plus miles, starting in Kuwait and eventually ending in Mosul, Iraq. Obviously, our construction equipment fleet was not able to drive itself that far, so external transportation assets were required.

The first movement of the 101st to An Najaf went very well, with heavy equipment transport support from the Corps, although the trucks were a week late in arriving because of their nonstop schedule. This delayed much of our equipment from moving north with our convoys of family of medium tactical vehicles (FMTVs) and high-mobility, multipurpose wheeled vehicles (HMMWVs). As the war progressed, we moved to Al Iskandariyah, south of Baghdad, and then on to Mosul, which required that we move via internal lift assets.

The best way to reduce transportation requirements is to reduce equipment. The light equipment company is very large; however, with a few equipment modifications, it could reduce its fleet in some areas but retain almost all of its capabilities.

Graders. The company has nine graders but could accomplish all its missions with eight. More importantly, we should trade all Caterpillar® 130GSs for Volvo G86 graders. Because the G86 is lighter than the 130GS, it can be moved via CH-47 helicopters without sectionalization. The G86 can also use external hydraulic attachments, similar to the Bobcat. One such attachment is a vibratory roller that can be towed behind

The 887th Engineer Company clears battlefield debris (destroyed T-72s) using the company's DEUCEs in the town of Al Mahmudiyah, Iraq, south of Baghdad.

the grader. Multiuse vehicles are the key to the future for the entire engineer force, not just the light equipment companies.

Loaders. The 950BS should be replaced with a smaller loader from the Family of Loaders Operational Requirements Document (ORD) currently being developed at the U.S. Army Engineer School. The light equipment company needs five new loaders from the Family of Loaders ORD that can be moved by one CH-47, air-dropped, and outfitted with other hydraulic attachments (such as concrete mixers, impact hammers, moldboards/blades, and modified scraper bowls) to make it a multiuse vehicle.

Scrapers. The 887th rarely uses scrapers in garrison and even less in combat. The company has nine MTOE scrapers but only deployed with six because it did not expect projects that would require the use of a scraper. After a couple of months in theater, we decided that even six was too many. There is very little possibility of constructing a new airfield, so few scrapers are required in the inventory. Preexisting airfields in every country make it easy for our rapid deployment forces to seize a functional or damaged airfield for operational use. It will always be faster to repair a damaged airfield than to build a new one. Therefore, light equipment companies of the future should only have three scrapers.

Skid Steers. Without question, the 887th could not have accomplished its missions without its six Bobcats—the most important pieces of equipment in the motor pool. As in Kandahar, Afghanistan, they were once again in constant use during the deployment. The unit used the sweeper attachments for everything from clearing airfields of debris to clearing out buildings for tactical operations centers. The pavement breaker, vibratory roller, and combination bucket were used during ADR. The only problem with the Bobcat is the lack of national stock numbers to requisition parts through the Unit-Level Logistics System–Ground (ULLS-G).

Vibratory Rollers. The light equipment company has six CS-433C vibratory rollers, and each of the six Bobcats in the 887th inventory has a vibratory roller attachment. The Bobcat roller is certainly best for repairing small craters on an airfield. Line platoons can survive with only the Bobcat. Support platoons should retain two CS-433C vibratory rollers for the company as a resource for large crater repairs (as experienced at Qayyarah West) and for large-scale compaction efforts on dirt airstrips.

Water Distributors. The current light equipment company has three water distributors. Two of the soon-to-be-delivered 613C models would be more than sufficient. We could have used these distributors constantly during Operation Iraqi Freedom, but we could not have procured enough water and soil stabilization solution to keep three water distributors in use. While the need is great for dust control in any operation (for debris control at airfields and especially for dirt MSRs and shoulders), the resourcing of the material to fill the tank is extremely challenging. A technique for the future is to fill the water distributor's empty tank before deployment with 5-gallon buckets of the soil stabilization solution. Therefore, once in theater the only required resource is water. An even better solution to further reduce the required transportation support is to field two to three skid- or trailer-mounted water tanks with spreader bars and/or sprayer attachments. This would cut the transportation requirement even further with no loss in capability. A pressurized spraying capability would be a significant enhancement to soil stabilization and dust control.

Other Equipment. There should be no change in the M1094 dump trucks, deployable universal combat earthmovers (DEUCEs), M1088 tractors, M984 heavy, expanded-mobility, tactical truck (HEMTT) wreckers, and HMMWVs, as they proved their value in type and quantity. Obviously, the table of organization and equipment (TOE)/MTOE writers should emphasize the need to retain the end strength of the company. Reducing the quantity of equipment and retaining the same number of soldiers and transport assets is essential. The most important weapon system on the MTOE is the soldier, and the unit could not function in theater without each of them. Planning convoys with a shortage of soldiers was extremely difficult. Additionally, trying to support operations on four airfields with a shortage of unit mechanics was a challenging problem to solve.

Providing security for missions further drained the already strained platoons. For several missions within Baghdad, the company had three times as many soldiers in the streets pulling local security as it did on the heavy equipment clearing the roads of battlefield debris. In addition, the battle losses from unexploded ordnance and enemy contact further depleted the ranks since five soldiers who were evacuated to the combat support hospital were losses for the remainder of Operation Iraqi Freedom. For these reasons, the value of every engineer soldier on the MTOE is far higher than any piece of equipment.

Maintenance

After Operation Iraqi Freedom, it is apparent that two fixes are needed to better maintain the light equipment company. The mechanics and noncommissioned officer leadership performed in an outstanding manner and kept the fleet moving, but a few changes would greatly improve the unit.

Hydraulic Systems Test and Repair Unit (HYSTRU) Trailer. The lack of a HYSTRU trailer caused delays in repair times, which hampered the unit significantly.

Direct Support. The light equipment company must have a direct support maintenance section on the MTOE, because it is often impossible to get support.

Summary

The light equipment company is an outstanding resource for the combat engineer battalion to which it is attached. The 887th Engineer Company was able to provide support to any mission required by the 101st Airborne Division. At one point, the 887th had assets at four different airfields, demonstrating the flexibility and capability of the unit. To guarantee its continued usefulness to maneuver commanders, the light equipment company must be transformed into a more rapidly deployable team, in parallel with the rest of the Army. In doing so, the Engineer Corps will ensure that it continues to have the light equipment company as a fully capable—and even more versatile—tool in the force structure.

Captain Kremer is a small-group instructor at the U.S. Army Engineer School, Fort Leonard Wood, Missouri. At the time this article was written, he was assigned to the 326th Engineer Battalion (Air Assault) in northern Iraq. He previously served as the battalion maintenance officer, assistant S3, and company commander of the 887th Engineer Company. Captain Kremer holds a bachelor's in both business administration and computer information systems from Thomas More College and is a graduate of the Engineer Captain's Career Course, Combined Arms and Services Staff School, Battalion Maintenance Officer Course, Sapper Leader Course, Air Assault and Airborne Schools, and Mountain Warfare School.

Operation Iraqi Freedom Warfighter Conference

The U.S. Army Engineer School (USAES) is hosting an Operation Iraqi Freedom Warfighter Conference in conjunction with the Society of American Military Engineers (SAME)/Army Engineer Association (AEA) South Central/South Atlantic Regional Training Conference in Savannah, Georgia, from 3-5 November 2003. Due to space constraints, only formal invitees may attend.

For registration and additional information, please visit the conference Web site at *<www.same.org/savannah/_2003/savannah2003.htm>*. The conference point of contact is Ms. Lindsay Fox at (912) 234-5300 or *<fox.l@thomas-hutton.com>*. The USAES point of contact is First Lieutenant Elizabeth Helland at (573) 563-7293 or *<hellande@wood.army.mil>*.

Helping Iraqis Rebuild Iraq

By Colonel James I. Vosler, Lieutenant Colonel Clarence D. Turner, and Captain Kevin J. Schrock

Task Force Neighborhood, an aggressive community outreach program, was developed by V Corps to help Iraqis rebuild their country. The initiative consists of "task forces" of coalition forces that go into neighborhoods and assist hired Iraqis with projects. V Corps's 130th Engineer Brigade took the lead in this effort. After gathering support from the local communities with these Task Force Neighborhood projects, Iraqis are contracted to develop and execute their own local community repair projects.

The 555th Engineer Group (Task Force Able), sometimes known as the "Triple Nickel," joined 4th Infantry Division forces—explosive ordnance disposal (EOD) and civil affairs teams, interpreters, contracting specialists, and medical/dental, military intelligence, and media personnel—to participate in the infrastructure repair program with reconstruction projects that included the following:

- Removing debris.
- Removing arms, ammunition, and unexploded ordnance (UXO).
- Constructing roads and bridges.
- Assessing facilities.
- Restoring power, water, and sewage treatment.
- Restoring hospitals, clinics, and schools.

Purpose

Specifically, Task Force Able's goal was to reinvigorate the Iraqi labor force to promote an upward trend in the economy and create advancement in civil works and engineering to rebuild the infrastructure of local communities. This enables forward progress in their social and communal

U.S. Army photo by SPC Adam Nuelken

A masonry specialist with Bravo Company, 142d Engineer Battalion, replaces wooden desktops and seats at the school in Al Hurriyah, Baghdad.

living and move toward stability and helps develop a positive perception of coalition forces.

Organization

We are structured to use the enablers to facilitate the rebuilding of Iraq. The use of the local population more than triples the engineer combat power in Task Force Able, enabling platoons to accomplish tasks normally assigned to a company or higher. An example of this is the repair of an eroded causeway of a bridge over the Tigris River. The division of labor for this project consists of 90 percent from local labor and equipment and 10 percent from Task Force Able's organic resources. These resources are organized through community action teams composed of Task Force Able engineers, local labor, and division augmentation. Task Force Able uses community action teams to conduct assessments of the condition of local infrastructure.

Contracting

Putting Iraqis back to work is our main intent. The 555th uses Office of Coalition Provisional Authority funds to hire local Iraqi workers and equipment operators. We also contract for resources such as rock, gravel, and sand to complete infrastructure projects that require them. Some of these projects are for joint use by the Iraqis and U.S. military. For example, the task force hired several former plant workers to fix the water pumps and generators to a water treatment plant in the town of Abu Rajash. This feeds water into the northern Tikrit area and the Al Sahra Airfield, which houses thousands of 4th Infantry Division soldiers. A member of Charlie Company, 223d Engineer Battalion (Task Force Knight), Mississippi National Guard, was able to put his civilian water treatment plant expertise to use and help negotiate the purchase of parts that brought the water treatment plant to full operation.

In addition, personnel from the 14th Engineer Battalion (Task Force Rugged) contracted for 350 loads of rock, gravel, and sand and used 20-ton dump trucks to repair an eroded causeway over the Tigris River. The gravel and sand will also be used to repair road craters in Iraqi Highway 1, which was damaged during the war. The 14th also contracted for equipment to rebuild the causeway—five 20-ton dump trucks, two excavators, two bucket loaders, a fueler, a grader, a water distributor, a roller, and a dozer. Task Force Rugged will provide the remaining equipment necessary for this repair. In addition to the above examples, personnel from the 223d Engineer Battalion negotiated several asphalt contracts to repair the Al Sahra airfield and several large road craters on Iraqi Highway 1 between Tikrit and Mosul.

UXO Clearance

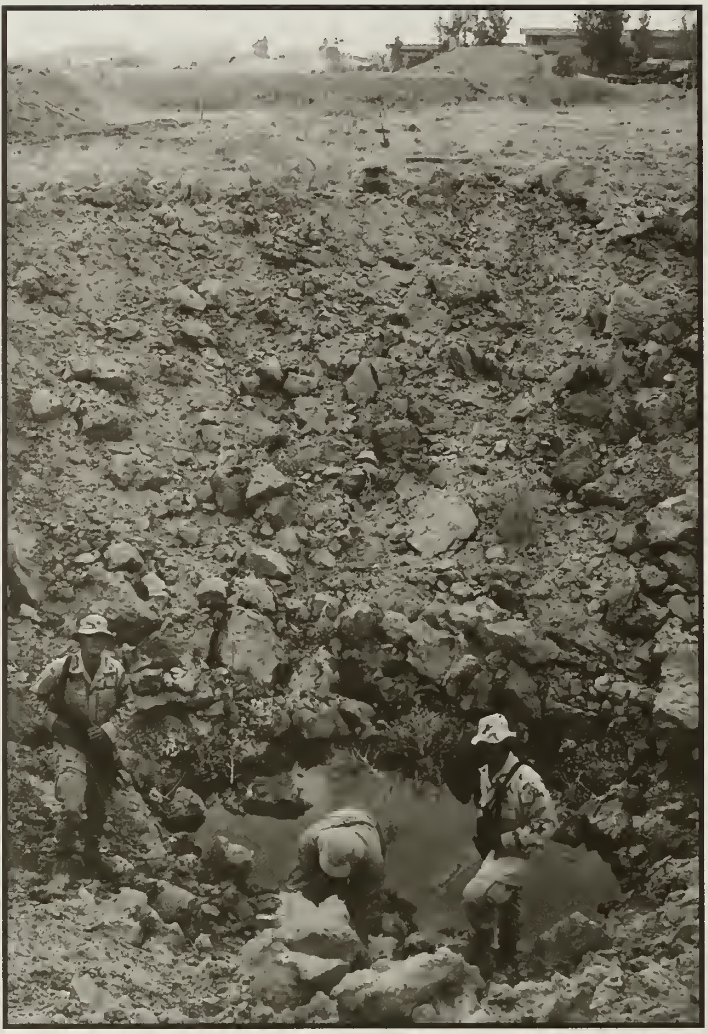
Most of the UXO found in Iraq is submunitions that present a safety hazard to the local communities throughout the country. UXO also posed a similar hazard to the rebuilding of Highway 1. The 47th Ordnance Company EOD team provided support to remove 150 cluster bomb munitions from three road craters in Highway 1, thus enhancing the safety of the local population. Alpha Company, 14th Engineer Battalion led a mine-clearing armor-protected (MCAP) D7 dozer crew to further clear the route. Additionally, Bravo Company, 14th Engineer Battalion, and the 47th EOD team cleared 51 cluster bomb munitions from a local community (Tall ath Thahab), enabling them to once again use the land for farming.

U.S. Army photo by SPC Adam Nuelken

A metalworker with the 535th Engineer Company braces a steel door while grinding off the rough spots. Soldiers welded hinges and repaired doors at an elementary school in Al Hurriyah, Baghdad.

Engineers

The Task Force Able engineers repaired a local water treatment plant, constructed an improved ribbon bridge across the Tigris River, completed a 500-meter bypass on the Buffalo Soldier Bridge, repaired several major road craters on Iraqi Highway 1, constructed a landfill, and replaced windows in the Tikrit hospital. The 565th Engineer Battalion (Provisional) (Task Force Renegade) constructed an improved ribbon bridge that provided assured mobility for U.S. forces



U.S. Army photo by SPC Joshua Hutcheson

Soldiers from Bravo Company, 37th Engineer Battalion, Fort Bragg, North Carolina, stand at the bottom of a 20-foot-deep crater made by an American bomb at an airfield in northern Iraq.

and the Tikrit community. Alpha and Charlie Companies of the 14th Engineer Battalion constructed a 250-meter causeway for this bridge. Following its completion on Saddam Hussein's birthday, the bridge was named the "Birthday Bridge."

Similar to this project, the 14th Engineer Battalion established a contract with the community of Az Zawiyyah to restore the causeway on the Buffalo Soldier Bridge. On 25 May 2003, the battalion completed work on a 500-meter two-way bypass on the southern side of the Buffalo Soldier Bridge causeway, 20 kilometers north of the city of Bayji, Iraq.

This project was undertaken to provide assured mobility across the Tigris River for Task Force Iron Horse and the local community. Before the bypass was completed, access to the bridge was via a rapidly eroding causeway that barely permitted one-way traffic. If this causeway failed, the nearest passable bridge would be in Tikrit, 60 kilometers to the south. Completion of this project ensures that the people of Iraq have a safe means to cross the Tigris River near Bayji.

The Bayji bridges, 9 kilometers to the south, were destroyed during Operation Iraqi Freedom. Charlie Company, 14th Engineer Battalion, undertook this project, which is only the first phase in repairing the causeway to full use. Later phases, which will be accomplished using mostly contracted labor and equipment, include measures to prevent future erosion and reconstruction of the original causeway, thus returning to the Iraqi people a vital lifeline across the Tigris River. Initial construction on the bypass was started on 5 May 2003, enabling one-way traffic. The battalion closed off the causeway and began rebuilding it with the use of Iraqi workers and equipment on 7 June 2003. This causeway is also of vital interest to Task Force Iron Horse as it is one of the division's alternate supply routes.

The 14th Engineer Battalion is repairing Iraqi Highway 1, just north of Bayji. The project is broken into four zones. Before the repair of Zone A, this section narrowed to one lane around one 15-meter-wide hole and a smaller 5-meter-wide hole, the results of an aerial-delivered bomb. A collapsed concrete box culvert that ran beneath the southbound lane complicated the repair. The culvert was demolished using explosives, then it was removed and replaced with new culverts to restore water flow beneath the route. In lieu of box culverts, we used round culverts and sandbag headwalls. Then the crater, along with collateral damage, was filled and compacted to accept traffic.

This is the first of four such repairs planned by the 14th Engineer Battalion. The remnants of an aerial-delivered bomb complicated the second set of craters, Zone C. More than 150 cluster bomblets were destroyed by the 47th EOD team to set conditions for future repairs. Completion of this project removes a bottleneck and ensures that the primary V Corps north-south main supply route remains open as a high-speed line of communication. It also facilitates the use of Highway 1 by local travelers. The use of local materials and equipment on the project is another example of the division's efforts to help Iraqis rebuild Iraq. This repair also prepares this section of Highway 1 to be repaved, restoring it to preconflict condition. The 14th also constructed a city landfill for a local community, just northwest of Tuz, Iraq, which will prevent random dumping of trash in the nearby community.

Infrastructure Assessments

The 14th Engineer Battalion conducted several infrastructure assessments during Operation Iraqi Freedom, which are used to identify future projects. The primary goal was to assess the condition of power, water, oil/gas, and infrastructure using the red, amber, and green rating method. These ratings allow Task Force Able engineers to prioritize future work. The assessments are used to hire local Iraqi workers and equipment, utilize troop labor and equipment, or seek a private cooperation to conduct the repairs.

Bravo Company, 5th Engineer Battalion (Task Force Fighter), conducted the following assessment of the Az Zawiyyah.

General

We entered the town and looked for an English-speaking man. We were approached by a man who worked at the Bayji refinery and lives within the town of Az Zawiyyah. He is the nephew of the town sheik, who lives farther east within the town (no location given). After a tour of the local water plant, the town deputy mayor, who spoke very good English, approached us. He was a colonel in the Iraqi Helicopter Corps during the war.

Utilities

- ***Water.*** *The water-pumping facility consists of four pumps from the Tigris River to two (30'x 8'x 15') holding tanks. Connected to the holding tanks are two chlorine-filtering tanks. Water distribution to the town itself consists of two pumps from each tank to the town. Currently, only one pump from the river works. However, there is no filtering of the water, and only one pump to the town actually works. The water pressure to the town is currently two bar (mostly gravity fed). Due to the poor quality of water, most of the town is suffering from dysentery, and a large portion of the town funds are going toward medicine to treat the illness. We have hired two local plumbers to fix the pumps. We have also hired personnel to add 12 kilometers of piping to provide water to the remainder of the town.*
- ***Electric.*** *The overhead power lines were strung in the 1970s and are in disrepair. Due to the problems with the power grid, there are daily power outages, which last from 2 to 6 hours. This severely degrades the town's quality of life and shuts down the local school.*

Schools

Due to power outages and money, many of the teachers do not come to work each day. As a result, the students are being held back this year in an attempt to help them catch up next year.

The company conducted a similar assessment in the town of Sharquat. The hospital needed some plumbing and carpentry work, and the school needed similar repairs. Task Force Rugged is working to hire someone to repair the plumbing in the hospital and school, and either Task Force Able engineers or contracted labor will perform the carpentry work.

Another key to helping Iraq is restoring the bridges damaged or destroyed through neglect and war. To enable one repair, an assessment was conducted with a representative from the U.S. Army Corps of Engineers Forward Engineer Support Team of the two damaged bridges in Bayji. These bridges will be repaired through contracted labor.

Limitations

Task Force Able engineers overcame several limitations as they executed Task Force Neighborhood:

Design

Since there were no box culverts available for the Zone A road crater project, we designed a culvert system with round culverts and sandbags as headwalls. The temporary fix should last long enough to allow the Iraqi government to reestablish itself and provide a more permanent solution. We also designed the causeway for the Tikrit Bridge using a geotextile. We constructed the causeway directly on the Tigris River using river rock, gravel, and sand. The geotextile allowed much better compaction of the aggregate.

Language

To overcome the language barrier, we used local community personnel or Task Force Iron Horse interpreters.

Cultural Differences

We adapted our work efforts to accommodate Iraqi culture differences. Since they do not work on Friday, we performed maintenance that day.

Resources

We negotiated the use of local rock quarries, labor, and equipment to overcome some of our resource shortfalls. The MCAP D7 dozer only clears UXO to a depth of 12 inches. Submunitions were found at 24 inches, so we used D9 dozers to overcome this limitation.

Force Protection

No project was started unless a thorough force protection plan was established and executed.

Conclusion

Operation Task Force Neighborhood is vital to the rebuilding of Iraq. Task Force Able engineers continue to assess infrastructure and hire local Iraqis to rebuild their country, while providing the coordination necessary to efficiently prioritize, resource, and manage the projects until the government is reestablished and this role can be turned over to the Iraqi people.

Colonel Vosler commanded the 555th Combat Engineer Group when this article was written. Previously, he served as the Executive Director of Military Programs at the U.S. Army Corps of Engineers headquarters in Washington, D.C. He also commanded the 35th Engineer Battalion at Fort Leonard Wood, Missouri.

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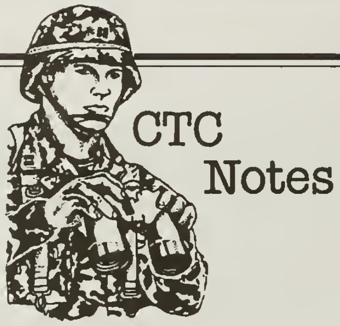

National Training Center (NTC)

Subterranean Complex Operations

By Sergeant First Class Josue A. Pinos

Subterranean complex (or cave) operations are part of the contemporary operational environment at NTC. These operations provide covered and concealed routes of movement throughout urban or mountainous terrain and replicate terrain condition challenges where our forces will fight.

A detailed knowledge of the nature and location of underground facilities is potentially of great importance to both the attacker and the defender. Maximizing the use of a subterranean complex could prove to be a decisive factor during urban or mountain operations. Units planning to conduct such operations should consider the following:

Tips for Success

- Use night-vision goggles with infrared (IR) sources.
- Use IR-filtered flashlights/white lights.
- Use field telephones and messengers.
- Use tag lines to guide soldiers along the route.
- Use shotguns or scatter-type munitions.
- Include caves on the modified combined obstacle overlay.
- Calculate demolitions needed for cave destruction.
- Integrate explosive ordnance disposal assets for search/ destruction of caches of weapons of mass effect.
- Review Field Manual 3-06.11, *Combined Arms Operations in Urban Terrain.*

Cave Complex Tunnel

Common Mistakes

- Lack of experience in neutralizing booby traps and obstacles
- Poor/inadequate communications
- Poor route marking
- Failure to consider chemical hazards

Highlights of Rules of Engagement

- No booby traps and pyrotechnics are authorized except the M117 simulator.
- Units are authorized to use meals, ready to eat (MRE) bag grenades as simulators in place of M84 stun grenades and M67 and M69 fragmentation grenades.
- No smoke grenades or CS (tear gas) canisters will be used within 10 meters of the cave entrance.
- No ammunition is authorized inside the cave except 5.56-millimeter blanks.
- Weapons may not be fired within 5 meters of another soldier.
- Stoves or open flames are prohibited inside the cave complex.
- Vehicles are not permitted to drive over or park on top of the cave complex.
- Units assaulting or occupying the cave complex must receive a safety briefing from their observer-controller (OC).
- No live demolitions (to include demolition-effects simulators) will be used in the cave complex without obtaining a waiver through the commander of the operations group.
- Eye and ear protection are required.

There are three cave complexes at NTC that challenge units and provide a more realistic training environment.

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Antipersonnel Obstacle Breaching System (APOBS)

By Sergeant First Class Josue A. Pinos

The APOBS is now a system of choice of rotational engineer units at NTC. The APOBS, which is relatively new to conventional forces in the Army, was live-fired during NTC's Mine Awareness Training in March 2003. NTC continues to develop and improve mobility and countermobility tactics employed by combat engineers. This system provides commanders with another alternative to reduce antipersonnel obstacles. Opposing Force (OPFOR) TM-89 mines directly under the line charge will be destroyed also because of their seismically influenced fuse.

APOBS Launch

Characteristics, Capabilities, and Features

- Two-person portable
- Total weight of 123.5 pounds
- Clears a 2-meter by 45-meter path through antipersonnel mines and wire obstacles
- Provides a 35-meter standoff
- Operates in delay or command mode
- Can be fired in under 2 minutes in the delay mode
- Simple and rapid operation

Highlights of Rules of Engagement

- The APOBS team executes proper setup procedures.
- The APOBS team simulates pulling the pin and waits 15 seconds before firing the grapnel cartridge provided with the APOBS trainer.
- If a grapnel cartridge is not available, an OC fires a white star cluster to simulate the rocket launch.
- Eight seconds later the OC will detonate a grenade simulator to replicate the detonation of the line charge.
- The OC will administratively clear any antipersonnel mines, antitank mines, and wire, beginning 35 meters from the point of launch and providing a 2-meter by 45-meter footpath.
- The unit must clear any mines left in the path using appropriate proofing/reduction techniques.
- Unprotected personnel within the 75-meter surface danger zone of the line charge will be assessed as casualties.

NTC offers a great opportunity for employing the APOBS.

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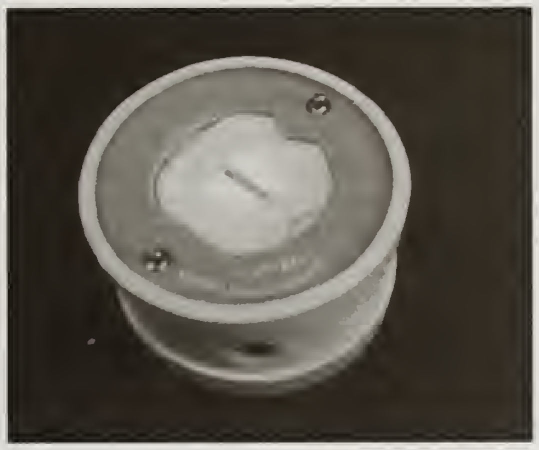
Mine Effects Simulator (MES)

By Sergeant First Class William Sutton

Battlefield fidelity is a critical aspect of every training environment. However, mines and mine replication during training historically challenge trainers. Fortunately, a coordinated effort by NTC, several TRADOC schools, and the Program Executive Office for Simulation, Training, and Instrumentation is improving the situation for Army units. These efforts resulted in the acquisition of 4,750 Multiple Integrated Laser Engagement System (MILES)-compatible MES mines for use at NTC beginning in late summer 2003. The purpose of this new equipment is to increase battlefield realism and better simulate the real-world effects of popular foreign antitank mines. The TM-89 antitank mine is the primary one used at NTC and replicates typical training issues. Before the implementation of the MES mines, the only way to adjudicate a minefield was for an OC to overwatch the event. The verification and validation of this important system will be complete by spring and will likely lead to additional future procurements of the MES.

Description

The MES has a tan body with a blue ring on top. Designed with the dimensions of a Volcano mine, the MES contains the components necessary to electronically inflict simulated battle damage to combat vehicles. The mine can be used in a mine shell to simulate a conventional mine, or it can be used alone to simulate a scatterable mine. The MES simulates the effects of antitank mines by emitting a signal to vehicles equipped with a MILES II and an MES receiver antenna. The MES receiver antenna is already part of the current MILES II and uses a radio frequency signal from the mine to the antenna. This training mine operates using two common AA batteries that should last up to 6 months. Soldiers simply depress the TEST/ARM switch on the side of the MES to test and arm the "mine." The MES becomes active 2 minutes after the switch is depressed. To manually disarm the mine, simply execute the same action.



Mine Effects Simulator

Usage

The MES will be employed by the OPFOR to replicate the TM-89 antitank minefields. When used with the mine shell, it will replicate both the standard OPFOR conventional minefields and minefields emplaced by the mobile obstacle detachment.

Highlights of Rules of Engagement

The effects of the MES will be automatic and will minimize the need for OC adjudication. However, rules of engagement will—

- Assess the vehicle if it straddles or strikes the mine.
- Assess casualties for troops in the open within a radius of 25 meters of the detonating mine.
- Require a 1-pound block of explosive placed next to, but not touching, the mine to reduce it when conducting a manual reduction.

All other reduction technique rules of engagement remain unchanged.

Mine effects simulators will provide NTC with increased training realism and improved battlefield effects and will allow a more productive training environment.

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Joint Readiness Training Center (JRTC)

Engineer Equipment Platoon Leadership: Operating in Support of a Light Brigade Combat Team

By Sergeant First Class Steven J. SanPedro and Staff Sergeant Joey W. Dunn

A trend in recent rotations at the Joint Readiness Training Center is that the platoon leader (PL) and platoon sergeant (PSG) perform duties as the blade team leader (BTL). This trend has developed as the BTL consistently takes a back seat to either the PL or the PSG during the linkup, control, and execution of blade teams in support of maneuver units. A direct result is that there are shortcomings in preparing and executing the brigades' survivability effort. Either the PL or the PSG is becoming the main point of contact for the supported unit when previously it was the BTL. To the supported unit, the PL or PSG appears to be the BTL rather than the brigade-level survivability command and control element. Each of the platoon's key leaders has a very important role in the platoon's survivability mission in the planning, preparation, and execution phases of the platoon's operation.

PL Duties and Responsibilities

The PL has the primary responsibility for planning and executing the brigade's force protection efforts and ensuring that his survivability plan is integrated with the maneuver plan. This great responsibility requires the PL to be very proactive. During recent rotations, the PL has been leading a single blade team throughout the operation. The PL can—and sometimes should—provide command and control for the blade teams during execution. However, the PL must collocate with the brigade tactical operations center (TOC) during critical times in the planning process and return to the battlefield during the preparation and execution phases. The required product from the planning process is the survivability timeline. The PL should assist with and provide expert feedback on the platoon's capabilities and its ability to support the brigade commander's priorities of work, including the maintenance and rest plans. The PL works closely and maintains constant communications with the brigade engineer, assistant brigade engineer, and PSG to coordinate details for execution of missions such as providing fuel, maintenance, and security escorts.

During execution, the PL should battle track the survivability efforts and the overall common operational picture of the battlefield. He must ensure that every member of the platoon knows the status of the routes, obstacles, and friendly and enemy minefields and forces. A method that works well for tracking the survivability effort is for the BTL to send updated survivability status reports on the company net to the PL. Reporting on the company net allows the company command post in the brigade rear engineer cell (BREC) to receive the updates at the same time the PL is receiving them from the BTL. This gives the BREC the current status and reduces the amount of times the information is handled from the point of origin. The BREC can then forward the updates to the brigade main engineer cell (BMEC) at the brigade TOC.

As the PL observes the current tactical situation, he may need to reassess and update the survivability timeline in order to give the brigade engineer the most current estimate and updated timeline. Additionally, the PL is responsible for the overall standard of the survivability positions provided for the brigade task force. The PL should coordinate logistics with the PSG for important sustainment items such as vehicle parts, food, fuel, water, and ammunition. The PL ensures the quick identification, evacuation, and repair of all critical engineer equipment assets and should coordinate with supported units for security and movement escorts to and from jobsites. There are many similarities in duties between the equipment PL and the task force engineer. (The duties and responsibilities of the task force engineer are in FM 5-7-30, *Brigade Engineer and Engineer Company Combat Operations [Airborne, Air Assault, Light]*.)

PSG Duties and Responsibilities

The PSG plays a unique role in the survivability process. Not only does he have the numerous responsibilities of his own position, but he also must know and understand the PL's job and be able to step in without notice to execute those duties. The PSG should maintain the current tactical and logistical battlefield situation. He is the primary technical adviser to the PL and should provide expert advice on the platoon's capabilities during survivability planning. The PSG is the technical expert on operator proficiency and noncommissioned officer skills. In addition to focusing on the overall platoon effort, he should be available for technical advice to the BTLs when needed. Most importantly, the PSG must track the platoon logistically and supervise the requisitioning of its supplies. This involves a great deal of coordination and constant follow-up with the company and forward support battalion in order to be successful.

The PSG should control the collection of casualties and ensure that casualties are evacuated to the appropriate level. An easily overlooked part of this process is following up on the requisition for personnel to replace those that are lost and then focusing on the integration of the new personnel as replacements are received. The PSG must take the lead in enforcing the platoon's maintenance program, ensuring that parts are getting ordered, and tracking the document numbers until the parts arrive. Once the parts are on hand, the PSG must either get the parts to the vehicles or get the vehicles evacuated back to the maintenance area for repair. The PSG should receive and distribute the platoon's load of food, water, ammunition, and fuel. Most of these items will be provided by the supported units through daily logistics packages. However, if the supported unit does not adequately provide the items, the PSG must step in and make sure the platoon gets the supplies it needs to function.

BTL Duties and Responsibilities

The BTL is the direct link between the platoon and the supported unit and must conduct linkups with the "CINC" dozer or other designated unit representative. For initial linkup procedures, the BTL must have a battle drill that is easily understood and executed by the blade team once it arrives on site. Much of the idle time on the battlefield can be attributed to the time waiting at a unit while the BTL is conducting linkup. Once on site, the blade operators must know what they are digging in and know that no matter what happens, they can get started on high-priority survivability efforts for that unit. During the linkup process, the BTL must coordinate for fuel, food, water, or any other support needed from the supported unit. After the linkup, the BTL should know the unit representative, the survivability requirements for the unit, when and where refueling will take place, and the location of all logistical support. Additionally, the BTL should confirm the unit's mission, the current enemy threat, the number of assets, and the terrain within the unit's area of operations in order to provide survivability recommendations based on the ability of the blade team to provide a sound survivability position. The BTL must adhere to the survivability timeline, to include the implementation and management of the maintenance and rest plans. Furthermore, the BTL should forward an updated status of the survivability effort at the position and coordinate early for the linkup, movement, and preparation of the next unit he will be supporting.

Summary

Each of the key leaders—the PL, the PSG, and the BTL—has an important role in planning, preparing, and executing the survivability plan. Proper understanding and implementation of these roles will provide the best opportunity for a successful plan. A good survivability timeline—with emphasis on the survivability standards—will leave every brigade asset on the battlefield with a doctrinally proven survivability position.

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Combat Maneuver Training Center (CMTC)

NCO Roles and Responsibilities in C2 Nodes

By Sergeant First Class Danny Petersen

The overarching role of staff noncommissioned officers (NCOs) is to free up staff officers and enable them to make critical decisions in a timely manner. Given that, people often assume that the primary function of NCOs in command and control (C2) nodes is to ensure that the generator is fueled and that the shift change occurs on time. Nothing could be farther from the truth or more harmful for efficient operations.

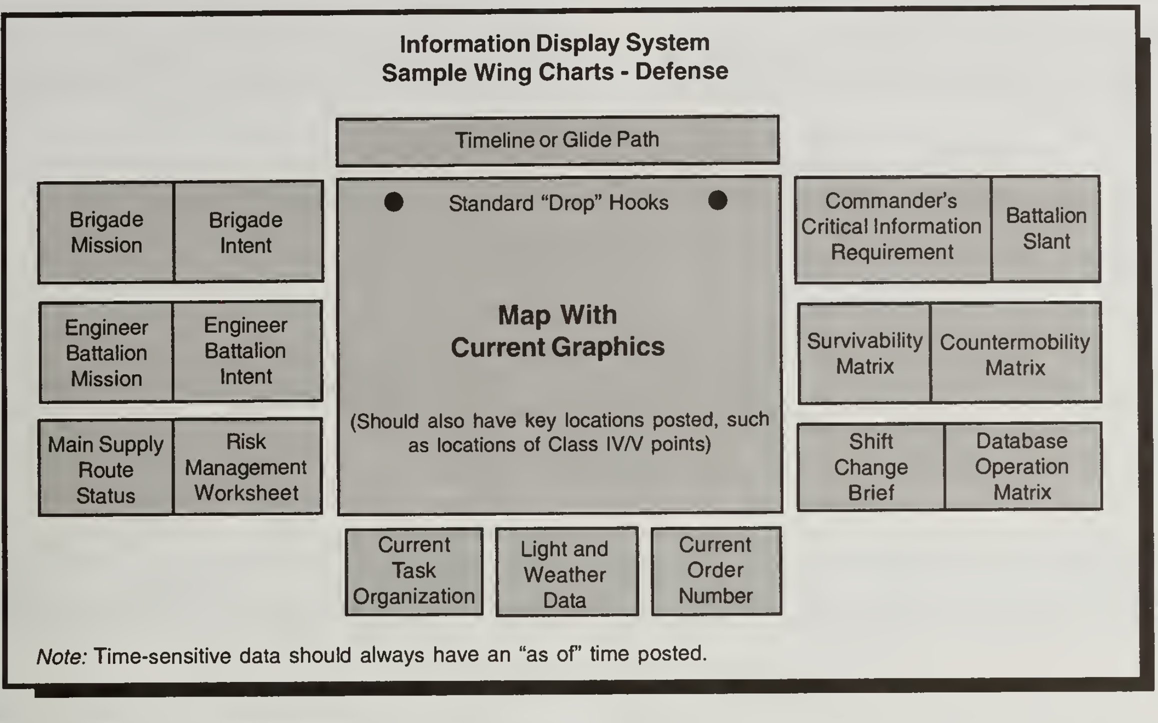
To help NCOs better understand their roles and responsibilities, they can refer to many doctrinal references; tactics, techniques, and procedures; and combat training center lessons learned. The most common doctrinal publication used to establish individual roles and responsibilities in the heavy engineer battalion tactical operations center (TOC) is Field Manual (FM) 5-71-3, *Brigade Engineer Combat Operations (Armored)*. Although Chapter 2, "Command and Control," does not spell out the specific responsibilities for the operations sergeant and battle staff NCOs, there are numerous implied tasks. Additional publications, such as the Center for Army Lessons Learned (CALL) Newsletter titled "Tactical

Operations Center" (No. 95-7, May 1995) and an engineer-specific CALL Newsletter addressing TOC operations (No. 99-12, October 1999), are helpful as well. Although these two references are an average of six years old, they provide a basic framework for TOC NCOs that is still applicable today. The following discussion applies mostly to units operating in an analog manner, although the main principles apply even when a unit becomes digital.

Typically, the operations sergeant and his shift NCOs have the background and experience to understand the six TOC functions—receive information, analyze information, submit recommendations, distribute information, integrate resources, and synchronize resources—from FM 3-90.3, *The Mounted Brigade Combat Team*, Chapter 3. TOC NCOs who know what information is important and how that information affects the mission become a real combat multiplier in the TOC. These NCOs are usually former platoon sergeants or squad leaders who understand how decisions made at the TOC affect the "guy on the ground." In contrast, the battle captains assigned to the TOC may be young lieutenants awaiting platoon leader duties, more experienced lieutenants awaiting the Captain's Career Course, or more experienced captains either awaiting company command or having recently completed command and pending a permanent change of station (PCS). The differing levels of experience may be vast. By providing both experience and continuity, TOC NCOs bring significant value to the fight—experience that manifests itself as a smoothly operating and functional TOC. At times, NCOs may feel that TOC operations are officer business, given the extensive use of computer programs such as TerraBase and Command and Control for Personal Computers (C2PC). However, the bottom line is that the operations staff will succeed or fail as a *team* of officers and NCOs and, in the process, will either enable the commander or relegate him to insignificance, based on the level of situational awareness the TOC maintains. The table below depicts actions NCOs can execute to facilitate the six command post functions. Although not all-inclusive, the table provides useful examples that can serve as a foundation for developing a unit TOC standard operating procedure (TOCSOP).

Command Post Functions and NCO Actions

Function	Actions
Receive Information	■ Monitor reports as received by the radio/telephone operator (RTO). ■ Ensure that the RTO records reports and maintains log. ■ Update unit/key leader locations on map when received. ■ Update combat power slants according to the unit tactical SOP (TACSOP), when required.
Analyze Information	■ Monitor key equipment losses (which may lead to a task-organization change). ■ Monitor information pertaining to the commander's critical information requirement (CCIR). ■ Update overlays and charts, as necessary, to maintain situational awareness. ■ Compare engineer TOC overlays with those of the brigade; if discrepancies exist, determine the cause and remedy. ■ Monitor proposed timelines and glide paths; compare these to subordinate-unit activity reports, and look for discrepancies.
Submit Recommendations	■ Provide insight on NCO issues and how proposed plans affect subordinate units. ■ Provide recommendations based on experience for time requirements (such as movement and execution of mine-clearing line charge [MICLIC] reloads and armored combat earthmover [ACE] dig rates).
Distribute Information	■ Inform the brigade of any changes to the combat power slant. ■ Brief all key personnel according to shift-change brief and schedule. ■ Use the system to file and maintain orders and reports. ■ Assist in orders production and publication. ■ Use the system to display information for key leaders (example provided in the chart on page 51).
Integrate Resources	■ Compare engineer overlays with other Battlefield Operating System overlays (such as combat service support and fire support [FS]) to ensure cursory integration; look for disconnects. ■ Monitor unit linkups for all task-organization changes; post when complete.
Synchronize Resources	■ Compare engineer timeline with brigade and subordinate-unit timelines; look for disconnects.



Information Display System
Sample Wing Charts - Defense

Timeline or Glide Path
Standard "Drop" Hooks
Map With Current Graphics
(Should also have key locations posted, such as locations of Class IV/V points)
Brigade Mission
Brigade Intent
Engineer Battalion Mission
Engineer Battalion Intent
Main Supply Route Status
Risk Management Worksheet
Commander's Critical Information Requirement
Battalion Slant
Survivability Matrix
Countermobility Matrix
Shift Change Brief
Database Operation Matrix
Current Task Organization
Light and Weather Data
Current Order Number

Note: Time-sensitive data should always have an "as of" time posted.

The chart above depicts an information display system that a battalion operations sergeant can easily establish. Staff officers, more often than not, fall in on existing systems and use what is available until they can make their own assessments about what information is needed. If a comprehensive and user-friendly system is in place and used by the NCOs, staff officers will experience a seamless transition and will develop more efficient TOC operations.

Further, how TOC NCOs execute and improve the information management and display system may be as crucial as the system itself. The attitude of "this is how we've always done it" may quickly turn people off in their attempts to improve the system. TOC systems must constantly be analyzed, and improved when and where necessary, while being integrated into the unit's TACSOP and TOCSOP. The TOC NCO should listen to other staff members and use their ideas to help improve products and mechanisms. Remember that people making suggestions are on the same staff and use these same systems, so they also have a vested interest in efficient operations. However, the engineer battalion operations sergeant should not just look internally to his staff. He must be familiar with the supported maneuver brigade TACSOP and ensure that the engineer battalion and maneuver brigade TACSOP complement each other. This is most critical in terms of reports and combat power tracking. Having complementary TACSOPs will generally yield more accurate information and improve information flow. When information tracking and management systems are not synchronized with the supported maneuver brigade, they generally will not work well for the engineer battalion and will likely cause redundant information management systems to satisfy brigade- and higher-level information requirements.

NCOs must also understand the roles of the staff officers they work with in the TOC. By understanding staff officer roles and relying on their own experience, TOC NCOs are more readily available to help with planning operations, providing intervention before problems escalate, gathering required information, and assisting an officer's transition to battle captain.

NCOs who are charged with TOC responsibilities, and who are proactive and research the previously referenced publications, communicate a positive intent to the chain of command that they want to be combat multipliers in the staff. For such NCOs, the chain of command should immediately begin the process of getting them to the Battle Staff NCO Course (BSNCOC), which is the only course that strictly places NCOs in all staff positions from division to task force level. This shows NCOs how all the pieces fit together and how they can directly affect every facet of the operation. Further, the BSNCOC teaches NCOs the skills that are necessary to develop and maintain efficient TOC systems. Educated and enthusiastic staff NCOs who understand their role in the TOC provide significant value to the team. Instead of just "doing their time," staff NCOs will likely find working in the TOC a very rewarding and eye-opening experience.

Sergeant First Class Petersen is the engineer battle staff NCO observer-controller at the CMTC. His previous assignments include assault section sergeant/combat engineer vehicle commander, 82d Engineer Battalion, Germany, and Assault and Obstacle Platoon sergeant/operations sergeant in the 58th Engineer Company, 11th Armored Cavalry Regiment (OPFOR), Fort Irwin, California.

PRIME-POWER CONSIDERATIONS FOR ENGINEER PLANNERS

By Captain Geoff Van Epps

Recent experiences in Iraq, Afghanistan, East Timor, and other global hot spots have shown that most theater or Joint Task Force-level engineer staffs are largely unfamiliar with the capabilities, limitations, and employment of prime-power assets. Because the 249th Engineer Battalion (Prime Power) is the only unit of its kind in the Army, staff planners simply lack exposure to the unit and training in the employment of its assets. Furthermore, the current doctrinal guidance in Field Manual (FM) 5-422, *Engineer Prime-Power Operations*, frequently comes up short in bridging the gap between theory and practice because the manual was written before prime power was reorganized into the 249th Engineer Battalion in 1994. (FM 5-422 is being revised and will be published as FM 3-34.483, *Engineer Prime-Power Operations*.)

The following four lessons have proven to be the most important and most repeated comments over the course of the past two years of operations.

"All Things Electrical"

Often, engineer planners pigeonhole prime-power soldiers into one or two specific missions rather than capitalizing on the full range of their capabilities. In fact, the prime-power production specialist (military occupational specialty [MOS] 52E [21P as of October 2003]) is the most versatile and best educated of the "green-suit" electrical specialties in the Department of Defense. Having completed an academically rigorous 50-week course and several technically challenging missions each year since entering the field, each prime-power soldier is capable of expertly accomplishing virtually any electrical mission, including technical assessments and design of power systems; installation, operation, and maintenance of power plants and distribution systems; maintenance and repair of circuit breakers and protective relays; and quality assurance on electrical contractors.

Recent missions which have showcased the versatility of prime-power soldiers include—

- Civil reconstruction efforts in Iraq.
- Installation and operation of four power plants in the Afghanistan theater.
- Base camp planning and design in Iraq.
- Technical reconnaissance of dozens of potential bases in Turkey.
- Construction of an overhead electrical-distribution system at Baghram Airfield.

Power plant installed in Kyrgyzstan

A prime-power soldier works in the snow to keep the power on.

- Electrical assessments in the Philippines.
- Maintenance of the backup power plant at Incirlik Air Base, Turkey.
- Acting as the contracting officer's technical representative on U.S. Army Corps of Engineers (USACE) power contracts.

Engineer planners who recognize the full spectrum of prime power's capabilities and use prime power accordingly will not only improve the quality of support that engineers can provide but will concurrently realize great time and cost savings.

Long Logistical Tail

In general, prime-power units lack the capability to self-sustain below the company level. Since the prime-power platoon is the basic building block in terms of capability (and the company headquarters' current deployment to Baghdad is its first for any operation since prime power was reorganized as a battalion in 1994), this means that most often, deployed prime-power units will need administrative, supply, maintenance, and other support.

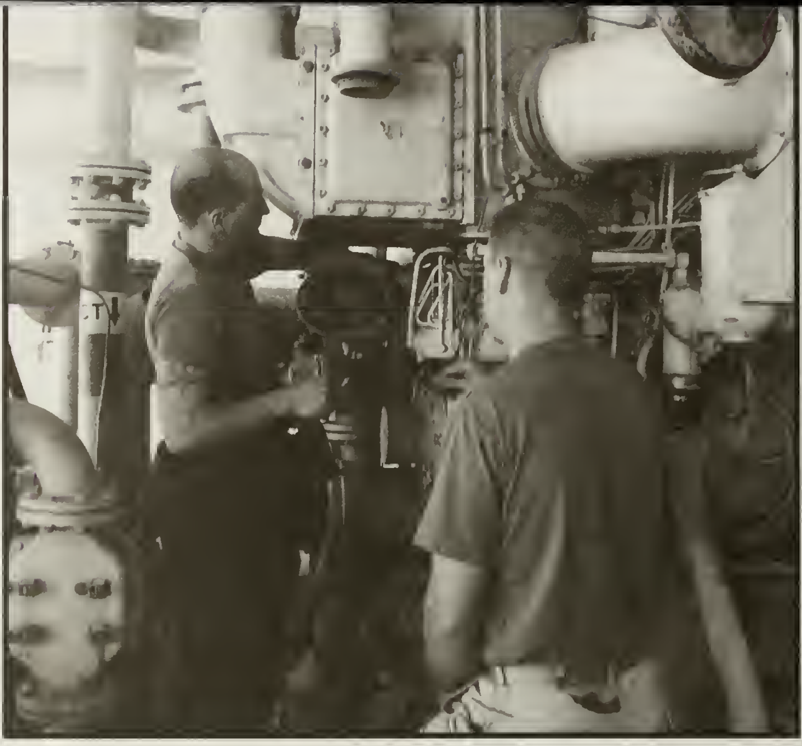
The prime-power platoon will require help in ordering and receiving parts and supplies since it has neither an organic supply noncommissioned officer nor a parts clerk. Lacking any mechanics other than for its generators, the platoon requires assistance with wheeled-vehicle and engineer equipment maintenance. With no personnel section, it needs support in processing finance and administrative actions. Finally, a prime-power platoon will require engineer support for excavation or trenching for installation of a distribution system.

If the company headquarters were to deploy (for instance, if two or more platoons simultaneously deployed to the same area), it would bring some of the support capability that the platoon lacks. However, prime power would still lack vehicle maintenance capability and the ability to provide its own dig support.

Although doctrine in this area is fuzzy at best, recent lessons learned have shown that an individual platoon is best tied in with a colocated engineer battalion (combat)(heavy) or a similarly organized construction task force. The company headquarters, being a theater asset, would report directly to the senior engineer unit, whether an engineer command, an engineer brigade (theater Army), or another engineer unit proportional in size to the theater headquarters. In cases where there is no local engineer headquarters of sufficient size, the best command-support relationship is to keep prime power attached to the nearest large engineer headquarters but make the platoon in general support of the local command. While the actual task organization will vary from mission to mission, the rule of thumb is to control prime-power assets at the highest level possible, since their capabilities will be required theaterwide and the soldiers will end up literally all over the battlefield conducting assessments, providing design expertise, offering technical assistance, and executing other missions.

Managing Expectations

Deploying prime power to support base camp development can be expensive, complex, and time-consuming, but it still offers the most responsive, efficient, and cost-effective means of providing reliable, utility-grade power to large military facilities during contingency operations. The timeline for procuring the bill of materials (BOM) required to construct an electrical-distribution system can be quite lengthy, since most industry has converted to



Two prime-power soldiers repair an Iraqi generator.

lean manufacturing techniques and small inventories, meaning that most materials are built to order. This can result in delivery schedules of 60 days or longer for materials. However, the procurement timeline for BOM can be significantly shortened by involving prime power in planning early, by anticipating mission requirements, and by using an "off-the-shelf" USACE IAP Worldwide Services Power Contract to streamline the contracting process.

As the 249th Engineer Battalion continues its force modernization process through fiscal year 2004, more platoons will be outfitted with the Deployable Power-Generation and Distribution System, which includes a great deal of "plug-and-play" materials that are compatible with Force Provider and the Air Force's Harvest Eagle/Harvest Falcon bare-base packages. Also, a good portion of the BOM for a base camp electrical system can be found in the Prime-Power Connection Kit, which is available with many Force Provider sets.

The BOM required for most prime-power missions, especially for nonstandard base camp construction, can be expensive, often resulting in initial sticker shock for the customer. For example, the material procurement cost for the 10,000-soldier base camp at Balad Airfield in Iraq was less than $10 million, but that cost will continue to grow (along with all other construction costs) as the standard of living in the theater improves. The high material cost is inherent in the significantly higher level of service and greater reliability afforded by prime-power over unit tactical generators. Engineer staff officers should anticipate the high cost and prepare the customer early to help mitigate sticker shock and manage expectations.

Another customer expectation that needs to be carefully managed is the time required to install a power plant and construct an electrical-distribution system. Once the power plant and associated equipment have been moved to their desired location (often a Herculean effort in itself due to the size and weight of the equipment, special material-handling requirements, and other factors), setting up the plant and delivering electricity to the customer is not an overnight process. Often customers perceive that once the generators are on the ground, prime-power engineers simply and quickly runs a big extension cord to all of the facilities on a base camp. On the contrary, the process of installing a grounding grid, switchgear, miles of cable, and dozens of transformers is a time- and labor-intensive process that requires clear guidance from the customer and prioritization to ensure that the most critical loads are serviced first.

Early In, Early Out

With only eight power-generation platoons on active duty and two more in the Reserve Component (see article on page 55), the 249th Engineer Battalion (Prime Power) is extremely small to be shouldering the U.S. Army's entire prime-power mission. Executing multiple rotations to support combat operations while honoring standing commitments in Korea, Hawaii, and Europe has proven to be a delicate balancing act. In September 2002, the battalion's soldiers were simultaneously engaging in missions in the combat zones of Operation Enduring Freedom, preparing for combat operations in Operation Iraqi Freedom, and conducting disaster relief in Guam, which stretched the unit's members to the breaking point. Consequently, prime power has evolved into an early-entry, contingency solution for filling military power requirements, with each deploying platoon capable of installing and operating a power plant, constructing an electrical-distribution system, and providing technical assistance and planning to fill follow-on power needs.

Power during the first 30 to 90 days of an operation should be provided by unit tactical generators. Prime power provides a transition from 30 to 180 days into an operation and would ideally be relieved by either commercial or contract power. Sources for contracted follow-on power include the Logistics Civil Augmentation Program, Air Force Contract Augmentation Program, (Navy) Emergency Construction Capabilities Contract, and the USACE IAP Worldwide Services Power Contract. Whatever the source, planning for follow-on power should begin early—ideally as soon as the requirement for prime power is identified—to allow for detailed planning and mobilization and the smoothest possible transition from prime power to its successor.

Captain Van Epps commands Bravo Company, 249th Engineer Battalion (Prime Power), Fort Bragg, North Carolina. His previous assignments include service with the 52d Engineer Battalion (Combat)(Heavy) and the 27th Engineer Battalion (Combat)(Airborne).

Live from Baghdad: It's Prime Power

By Staff Sergeant Robert Stephenson

It is probably the smallest unit currently mobilizing through Fort Dix, New Jersey, and yet its specialty makes it indispensable to the military. Alpha Company, 6th Platoon, 249th Engineer Battalion (Prime Power), is an elite unit of nine reservists from Attleboro, Massachusetts, that works on high-tension power lines and is responsible for making sure that all power keeps flowing through the system uninterrupted. Just as the Signal Corps is the Ma Bell of the military, the prime-power unit can be considered the ConEdison of the military. The fact that there are so few soldiers who are able to work on high-tension power lines means that the well-traveled unit works all over the United States and overseas on a regular basis.

Normally on active duty about two or three months out of the year, the unit is brought in for Federal Emergency Management Agency missions, disaster relief, and power assessments—in addition to its regular training missions. The unit also receives orders from the U.S. Army Corps of Engineers for active duty special work. As power-distribution experts, the unit is the only one authorized to work on "energized" or live power lines. This means that its soldiers can make repairs while up to 30,000 volts of electricity surge through the lines. About 80 percent of the unit members are civilian power line workers. Although the Army does provide a 2-month school for power distribution and a 1-year school for power generation, having civilian experience gives soldiers the needed expertise to be able to handle live wires.

Having such a specialized unit in the Army has its distinct advantages. When the unit goes places, literally millions of dollars are saved. Working live is important in missions where power must run continuously during the repair process, such as at military airports. Besides the cost savings, another advantage of using the prime-power unit over civilian contractors is that its soldiers already have all the clearances necessary to work in secure areas.

The crew sets a pole near the CJTF-180 building at Baghram Air Base, Afghanistan. A total of 130 45-foot concrete poles were set there by the 249th Engineer Battalion.

Soldiers from Bravo Company, 6th Platoon, 249th Engineer Battalion, erect a pole as they repair the high-voltage electrical system at Baghdad International Airport.

In September, Alpha Company replaced its sister unit (Bravo Company) in Iraq, where it is helping rebuild the infrastructure of major cities such as Baghdad. Among other missions, Bravo Company's power-distribution unit completed work on power lines that had been attached to a bridge destroyed during the conflict in Iraq. Those power lines carried electricity to one of Saddam Hussein's palaces, which is currently being used as a U.S. military headquarters.

As might be expected, the soldiers in the unit who work for municipal and local power companies take a pay cut when deployed, but that doesn't seem to faze them. They believe that what they do is important and that they contribute a valuable service to their country.

Staff Sergeant Stephenson, a New Jersey National Guard soldier, is currently mobilized with his public affairs unit at Fort Dix, New Jersey, in support of Operation Enduring Freedom, where he serves as the NCOIC of the broadcast section. When not deployed, Staff Sergeant Stephenson works full time as the Public Affairs NCOIC for the New Jersey National Guard Counterdrug Task Force.

Note: There are no active duty transmission and distribution specialists (MOS 52G [21Q as of October 2003]); they are all members of the Army Reserves. The 21 MOS 52Gs stationed in Attleboro, Massachusetts, are divided into Alpha and Bravo Companies, 6th Platoon. Both are part of the 249th Engineer Battalion, which is headquartered at Fort Belvoir, Virginia.

Photos by CW2 Donald McRae

Enlisted PERSCOM Notes

By Lieutenant Colonel Jack F. Smith

Greetings from your Engineer Enlisted Branch at PERSCOM. Since I will soon be leaving to become the Combat Support Division Chief, the next PERSCOM notes will come from Lieutenant Colonel Margaret Burcham, who is moving here from Germany. It has truly been a great experience to work with the Engineer Branch team and serve the soldiers of the Corps of Engineers. While I am moving into a new position, I'll still have responsibility over the engineer community, as well as the Military Police, Military Intelligence, Transportation, Aviation, and Signal Corps. So if you have enlisted issues that you think I can help with, let me know.

Health of the Regiment

The Engineer Regiment is well manned across the Army (see Table 1). While we have some small shortages in military occupational specialties (MOSs) 12Z, 51Z, and 81Z, 17 of the other engineer MOSs are above 100 percent. Our biggest challenge continues to be MOS 12B, which is enrolled in the Army's top ten critically short MOSs. Over the past four months, more than 1,000 new soldiers graduated from advanced individual training and reported to units in the field, which has decreased our shortage of skill level one sappers throughout the force. We fully expect the MOS to be healthy by the beginning of fiscal year (FY) 04. Most units also have 12B20 shortages. The primary reason for this shortage of sergeants is due to the number of sergeants on recruiting duty (about three mechanized battalions' worth of sergeant E5s). Over the next year, we will gradually decrease that number to get our manning in troop units back to a manageable level.

We do still have significant challenges in MOSs 51M and 00B at the noncommissioned officer (NCO) rank that simply will not go away until the units do their job to get soldiers prepped and to their respective promotion boards. I've repeated this story several times, but I will not let it go as long as the NCO shortages continue in these critical engineer MOSs and anyone asks my opinion.

Recruiting and retention have been well above historical averages across the Army and in the Engineer Regiment. Our FY03 recruiting program is all but sold out for FY03, and we have sold the majority of the first quarter FY04 seats. On the reenlistment side, all but 3 of our 21 specialties are well above the five-year historical trend. Current trends indicate that this success rate will continue. However, our reenlistment rates for MOSs 12Z, 51Z, and 81Z have been well below the historical average. Apparently, senior NCOs are making a lot of significant career decisions.

As of the publication of this article, there should be no engineer MOSs under the stop-loss program, which allows the Army to retain soldiers with critical skills on active duty beyond their separation date. Soldiers currently serving under stop-loss conditions will be allowed to depart the Army during the October-December 2003 timeframe. For those of you who were impacted by the Stop-Loss Program, I want to express to you my gratitude for the sacrifices you have personally made to serve our country. You all are simply great Americans.

MOS	Authorized Strength	Strength (percent)
12B	8,182	99
12C	672	103
12Z	264	94
00B	129	112
51B	882	118
51H	446	104
51K	116	103
51M	248	105
51R	128	148
51T	256	121
51Z	132	94
52E	184	107
62E	1,323	105
62F	277	101
62H	103	99
62J	664	106
62N	469	101
81L	232	102
81T	470	109
81Z	23	96
82D	110	109
Total	15,310	102.6

Table 1. Engineer Enlisted Operational Strengths (as of 30 May 2003)

Engineer MOS Conversion

Effective October 2003, all of the engineer MOSs are being redesignated to a 21-series nomenclature as part of the Army's MOS conversion program. Table 2 lists the deleted engineer MOSs, the new 21-series nomenclature, and the Professional Development NCO (PDNCO) here at PERSCOM who manages the respective MOSs.

These changes will be hard. MOSs 12B, 51B, 62E, and 81L hold special meanings to us old soldiers, and many of us will struggle to remember exactly what a 21S or a 21V is. On the other hand, changes such as these will provide some great benefits to our Regiment. There are few in the Army who know what an MOS 00B is or that it is a critical engineer MOS. With the designation 21D, it will be easy to discern that it is an engineer MOS.

Although some MOSs in the Army that are being merged and/or realigned will impact career progressions, NCO development, and the like, this is not the case for engineers. All of our MOSs simply change designations, with no impact on career progression, MOS training, or promotion opportunities.

Old	New	MOS	PDNCO
21A	21A	Engineer Officer	MSG Boyce
12B	21B	Combat Engineer	MSG Boyce
12C	21C	Bridge Crewmember	MSG Boyce
00B	21D	Engineer Diver	MSG Williamson
62E	21E	Heavy Construction Equipment Operator	MSG Williamson
62F	21F	Crane Operator	MSG Williamson
62G	21G	Quarrying Specialist (Reserve Component)	MSG Williamson
51H	21H	Construction Engineering Supervisor	MSG Williamson
62J	21J	General Construction Equipment Operator	MSG Williamson
51K	21K	Plumber	MSG Williamson
81L	21L	Lithographer	SFC Banco
51M	21M	Fire Protection Specialist	MSG Williamson
62N	21N	Construction Equipment Specialist	MSG Williamson
52E	21P	Prime Power Production Specialist	MSG Williamson
52G	21Q	Transmission and Distribution Specialist	MSG Williamson
51R	21R	Interior Electrician	MSG Williamson
82D	21S	Geodetic Surveyor	SFC Banco
51T	21T	Technical Engineer Specialist	MSG Williamson
81T	21U	Topographic Analyst	SFC Banco
62H	21V	Concrete and Asphalt Equipment Operator	MSG Williamson
51B	21W	Carpentry and Masonry Specialist	MSG Williamson
51Z	21X	General Engineering Supervisor	MSG Williamson
81Z	21Z	Topographic Engineering Supervisor	SFC Banco
12Z	21Z	Combat Engineering Senior Sergeant	MSG Boyce

Table 2. Engineer MOS Conversions

Assignments

A large portion of our active Army is fully committed in units around the world: three-plus divisions in the Middle East, a brigade-plus in Afghanistan, a brigade-plus in the Balkans, a division in Europe, and a division in Korea. This situation leaves only a very small pool of soldiers to rotate through critical assignments both stateside and overseas. We will be placing soldiers on assignment with even less than two years time on station to meet pressing Army readiness needs—and with as little as two months notification. As an institution, we don't like to do this to our soldiers, but those are the circumstances we now face in order to meet the needs of the Army. As the situation stabilizes and our soldiers redeploy, we will be able to return to many of the stabilization and assignment policies that were in place before the global war on terrorism, but it will take us some time to get there.

The assignments will come, so be ready. I'll use this opportunity to put in another plug for the Assignment Satisfaction Key (ASK) program that can be found on the Army Knowledge Online Web site <*http://www.army.mil/ako/*> and the PERSCOM Web site <*http://www.perscom.army.net*>. You should go there and update your volunteer and assignment preference data. Even with our current needs to place soldiers in Korea and other places, the first thing we still look at as we look for candidates is the ASK data.

For soldiers deployed overseas, I'm sure you're wondering if you'll be placed on orders as soon as your unit returns to the continental United States (CONUS). The answer is that many of you may well be placed on orders. We are reducing strengths of units in our institutional Army to continue to send replacements overseas. Our intent is to backfill these shortages in our training base, drill sergeant program, recruiting, Active Component/Reserve Component, and other areas with soldiers who return from deployment. You'll be given at least 90 days to stabilize after your deployment, but then many of you will be sent somewhere in CONUS. Obviously, it is very important that you update your ASK data.

Promotions and Training

With all of the unit and individual deployments around the globe, we do have a significant number of soldiers who have either deferred or were pulled out of the NCO Education System. Whether it was the Primary Leader Development Course, Basic Noncommissioned Officers Course, or Advanced Noncommissioned Officers Course, these soldiers will be rescheduled for schooling as soon as their deployment and stabilization allows. Many of these schools will be a temporary duty assignment while en route to new locations.

For information on pending selection boards, visit the PERSCOM Web site. It's up to you to review your Official Military Personnel File. You can obtain a copy by following the procedures posted at the Web site.

Contacting Us

The sole function of the Engineer Enlisted Branch at PERSCOM is to support soldiers and commanders in the field. I encourage you to contact your assignment manager, PDNCO, Branch sergeant major, me, or Lieutenant Colonel Burcham with any questions you have about assignments or professional development. The PERSCOM Web site has information on how to reach us. Remember, the only thing in the assignment process that does not have to be a variable is your preference. Take the time to let us know your preference.

Lieutenant Colonel Smith has been the chief of the Engineer Enlisted Branch for the past year. He previously commanded the 44th Engineer Battalion in Korea and prior to that was a war plans analyst at the U.S. Strategic Command, Offutt Air Force Base, Nebraska. Lieutenant Colonel Smith holds a master's in nuclear engineering from Penn State, a master's in military science from the Advanced School of Military Studies, and a master's in strategic studies from the Army War College.

Regimental Awards - Reserve Component

Each year we recognize the best noncommissioned officer, lieutenant, and engineer company, in each of the components, for outstanding contributions and service to our Regiment and Army. Every engineer unit in the Regiment can submit the name and achievements of its best of the best to compete in these distinguished award competitions. Only the finest engineer soldiers are selected as recipients of these awards. They will carry throughout their careers the distinction and recognition of being the Engineer Branch's best and brightest soldiers and leaders. The results of the 2002 Active Component Itschner and Grizzly Awards and Sturgis Medal selection boards were listed in *Engineer,* April-June 2003, page 26. The selections for the Reserve Component are as follows:

The Itschner Award committee selection for the U.S. Army Reserve: Headquarters Support Company, 463d Engineer Battalion (Combat)(Heavy), Wheeling, West Virginia, and for the Army National Guard: Alpha Company 1088th Engineer Battalion, 256th Infantry Brigade, Opelousas, Louisiana.

The Grizzly Award Committee selection for the U.S. Army Reserve: First Lieutenant Mark Dibble, 652d Engineer Company (Multirole Bridge), Ellsworth, Wisconsin, and for the Army National Guard: First Lieutenant John G. St. Romain, Bravo Company, 1088th Engineer Battalion, 256th Infantry Brigade, New Roads, Louisiana.

The Sturgis Medal committee selection for the U.S. Army Reserve: Sergeant First Class Lawrence Spradley, Headquarters Support Company, 854th Engineer Battalion (Combat)(Heavy), Kingston, New York.

All of the nominees represented their major commands with the highest professionalism and dedication to the Engineer Corps's vision and deserve our highest praise. The award recipients will be recognized at the U. S. Army Corps of Engineers Ball, tentatively scheduled for 17 October 2003.

For many years, senior leaders of the Regiment have debated about an appropriate award to recognize the very best engineer soldier, private through specialist. In keeping with the tradition of naming such an award after a distinguished member of the Regiment, the Regimental Command Sergeant Major, along with other senior sergeants major, recommended and gained approval for an award named after the most distinguished command sergeant major in the history of our Regiment—the fourth Sergeant Major of the Army, Leon Van Autreve.

The award is significant for two reasons: first, it was created to recognize the most outstanding junior enlisted soldier of the three components of our Regiment as a tribute to one of our Army's greatest champions of welfare and care of soldiers and their families; second, it showcases and highlights the important and significant service our junior enlisted soldiers provide to our nation. They are truly our most valued resource, and we wouldn't be the Army or Regiment that we are without their selfless and dedicated service. The Van Autreve nominations will be submitted for FY03 and presented at ENFORCE 04.

Lieutenant General Robert B. Flowers
Chief of Engineers

Major General R.L. Van Antwerp
Commandant, U.S. Army Engineer School

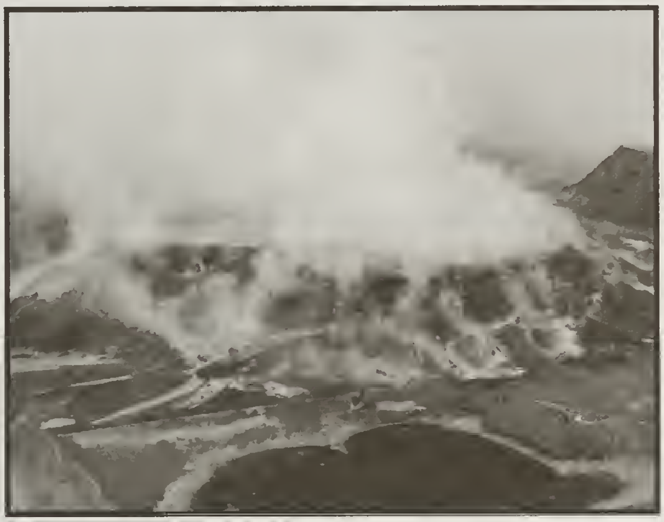
ENGINEERS BATTLE SULFUR FIRE

By Mr. Thomas O'Hara

This was not in their battle plan. They had no training for this. But American soldiers and Army engineers answered the call to fight a toxic sulfur fire creating a boiling lava-like melt that crept toward the Tigris River and threatened the water supply in southern Mosul, Iraq.

Wearing chemical masks to protect their lungs from nauseous sulfur fumes, members of the composite task force "Camp Sulfur" quickly stemmed the advance of the fire while working four-hour stints in the hot desert terrain. Choking off the caches of sulfur that constantly refueled the inferno, Army engineers turned the tide of flames and gradually smothered the threat to nearby citizens of Mosul. Members of the 326th Engineer Battalion, 52d Engineer Battalion, 926th Engineer Group, and 887th Engineer Company cooperated in the effort.

While American forces accomplished this effort without injury or loss of life, the fire took its toll on an Iraqi fireman who was killed during the effort. Apparently thrown from a fire truck in the haste to quell the flames, the man landed in the lava-like pool and quickly burned to death. A countryman, trying to save his friend, was severely burned and evacuated for medical assistance.



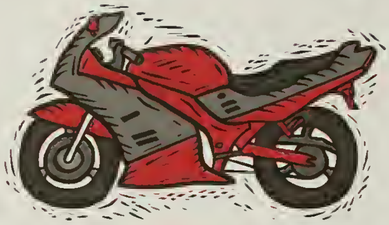
Aerial view of sulfur fires north of Mosul

The 326th Engineer Battalion officer in charge of fire fighting (left) discusses sulfur fires with soldiers.

Investigations were underway to determine if the fire was deliberately set as an act of vandalism or sabotage. Nonetheless, the response of Army engineers, in partnership with local Iraqis, prevented this environmental hazard from becoming a catastrophe.

Mr. O'Hara is a public affairs specialist and electrical engineer with the Omaha District, U.S. Army Corps of Engineers.

Photos by Jonas Jordan



MOTORCYCLE RIDER RISK MANAGEMENT

By Mr. Fred E. Fanning

Can risk management be the solution to everything? Maybe not, but it can go a long way toward preventing fatal motorcycle accidents. The Motorcycle Safety Foundation (MSF) has done a great deal of work to develop training programs to provide riders with the skills necessary to prevent motorcycle accidents. Riding a motorcycle can be a very dangerous sport or activity. However, by training properly and applying risk management, riders can help prevent crashes. The Army uses the MSF curriculum for motorcycle rider training as the standard.

History

In the 25 April 2003 issue of *USA Today*, Jayne O'Donnell reported that motorcycle fatalities were up in 2002 for the fifth straight year.[1] She indicated that this was a 3 percent increase. Ms. O'Donnell obtained her information from the National Highway Traffic Safety Administration, which has two very interesting reports on this subject on its Web site at *<http://www.nhtsa.dot.gov/>*.

In an article in the April 2003 *Countermeasure* publication, Master Sergeant Dave Hembroff raised the issue of motorcycle riders' risk of being involved in an accident.[2] He indicated that a rider who had not taken a rider training course was nine times more likely to be involved in an injury accident. Through February of 2003, Army personnel had 18 motorcycle accidents for the fiscal year. Six soldiers died in those accidents.

Conducting Risk Management

Accidents are normally the result of a series of events or factors that lead up to the accident. By controlling or eliminating some of those factors, the risk of being involved in a motorcycle accident can be greatly reduced. This is the process outlined in Field Manual 100-14, *Risk Management*, that we use for military operations and should use for all aspects of our lives. There are three primary areas that should be addressed in conducting risk management for motorcycle riding: rider factors, motorcycle factors, and road and traffic factors. See Table 1 for additional information. Each of these areas contains a number of factors that determine a rider's risk of being involved in an accident.

Rider

Riders should always be prepared to ride the motorcycle. That may sound a little strange, yet it is true. The rider of a motorcycle must focus his or her attention on the task of riding the motorcycle as well as the actions of other drivers, wildlife, and the condition of the road—all at once. This is far more focus than any automobile driver puts into the task of driving.

The amount of time riders have on their motorcycles has a great impact on the potential for an accident. The more you ride, the better rider you become. As service members or Department of the Army civilian employees, motorcycle riders are required to complete a course that is offered at most installations and provides basic information about riding. But don't let this be the only course you take. The more training

Type	Factors
Rider	Experience, training, protective clothing and equipment, consumption of alcohol and drugs, and lack of sleep
Motorcycle	Size, fit, and working condition
Road and Traffic	Road and highway conditions

Table 1. Factors to Consider in Risk Management

you get, the better rider you will become. Go to *<http://www.msf-usa.org>* to get more information about motorcycle rider courses in your area.

Army Regulation 385-55, *Prevention of Motor Vehicle Accidents*, lists the required items of protective clothing and equipment that each rider must wear. See Table 2 for a complete list. The quality of the clothing and equipment has a direct relationship to how much risk is accepted. Riders who purchase the bare-minimum clothing will reduce their risk of being injured in a motorcycle accident. However, purchasing quality motorcycle rider gear can reduce this risk even more. Helmets are a good example. Riders on a military installation must wear at least an approved 1/2-shell helmet. However, if they were to wear an approved 3/4-shell or a full-face helmet, they could reduce their risk even more. The same thing goes for the shirt or pants. Riders can wear a regular pair of pants and a shirt with long sleeves and get by. But they would be much safer if they wore the new jackets and pants with ballistic protection sold by many manufacturers today. This ballistic protection is located in areas where the body is most likely to be injured in a crash. Using it will greatly reduce the risk of injury in an accident.

Since riding a motorcycle requires a great deal of concentration, it is surprising that many riders still drink and drive. If you plan to drink, don't drive. Your chances of having an accident are far greater if you have been drinking. Riders should make sure they don't take prescription or over-the-counter medications prior to riding. Read the label, and if it has a warning about driving or operating heavy equipment or machinery, that means you don't ride. Along with these hazards comes the risk of riding when you're tired. As you know, it is very hard to drive a car when you're tired; it is much worse trying to operate a motorcycle. You may think that you are riding fine until an emergency occurs and you can't react to it.

Motorcycle

Even though you may be prepared to ride, is your bike ready to be ridden? First, does it fit you? And secondly, is it in good working order? Is the bike the right size for you? You can tell by sitting on the seat and putting both feet flat on the ground. If you can't do this, the bike is too tall. Now try to reach all the controls. You must be able to reach the handlebars, clutch lever, brake lever and pedal, throttle, and shift lever with ease. And is your bike in good working order? How do you know? The MSF has a preride checklist that is represented by the acronym T-CLOCS:

- T - tires and wheels
- C - controls
- L - lights and other electrical items
- O - oil
- C - chassis
- S - side stand

By conducting this quick inspection and fixing those items that don't work, you can greatly reduce your risk.

Road and Traffic

The last things to consider are the road and traffic conditions. You can choose the place and time you ride; make it the safest time and place. Don't ride in areas with limited visibility or rough and sandy roads. These can cause or

Clothing/Equipment	Description
Helmet	They come in full face, 3/4 shell, and 1/2 shell. The Department of Transportation or Schnell Foundation must approve the helmet. The full face provides the best protection followed by the 3/4 shell. The 1/2 provides the least amount of protection.
Gloves	They should be leather and have full fingers. It is best to purchase motorcycle gloves because they are sewn to put the seams outside the glove and curve of the fingers.
Shirt	They should have long sleeves and be made of a durable fabric. Consider a jacket or riding suit with ballistic protection.
Pants	They should be long and made of a durable fabric. Consider pants or a riding suit with ballistic protection.
Reflective Material	Many use a road guard vest or jogging belt. The jogging belt is only visible when it is worn diagonally across the torso.
Shoes	Should be over-the-ankle boots or shoes. No high heels on boots and no large toes. Consider a pair of motorcycle boots.
Protective Eye Wear	Don't rely on the face shield to protect you. Wear impact-resistant eyewear even if you wear a face shield. Invest in a pair of impact-resistant sunglasses.

Table 2. Required Protective Clothing and Equipment

contribute to an accident. You may also want to avoid heavy traffic times. Most car and truck drivers are not watching for motorcyclists and often don't see them. Not riding in these time periods can reduce your risk.

Strategy

In addition to identifying the hazards and eliminating those you can prior to riding, the MSF recommends a strategy for riding your motorcycle. The strategy is known by the acronym SEE.

- S - Search for hazards constantly as you ride.
- E - Evaluate those hazards first to determine if they have an impact on you, then develop a course of action for each.
- E -Execute the course of action you determined in the evaluation step.

Sounds familiar. doesn't it? This is a constant update of the risk management process. The more you use it, the better you will become.

Summary

Whether you are a new rider or have been riding for 20 years, you can become the victim of a motorcycle accident. You can reduce the potential for that accident by using the risk management process described in this article to identify and eliminate hazards. Don't become overwhelmed by all of the hazards. Riding a motorcycle is more dangerous than driving a car, and most—if not all—riders know this. To be a successful rider, control the hazards you can, and reduce your risk. Let motorcycling be fun and enjoyable.

For additional information, refer to the U.S. Army Safety Center Web site at *<http://safety.army.mil/home.html>* or the Motorcycle Safety Foundation Web site at *<http://www.msf-usa.org>*.

Endnotes

[1] Jayne O'Donnell, "Traffic deaths rise to 12-year high," *USA Today*, 25 April 2003, p. A-1.

[2] Master Sergeant Dave Hembroff, "Learn and Live," *Countermeasure*, April 2003, pp. 16-18.

Mr. Fanning is the safety director for the U.S. Army Maneuver Support Center and Fort Leonard Wood. He is also nationally certified by the Motorcycle Safety Foundation as a RiderCoach and serves as the RiderCoach/instructor for Fort Leonard Wood. He can be contacted at <fred.fanning@us.army.mil>.

Task Force Neighborhood

By Specialist Joshua Hutcheson

The streets of Mosul are slowly but surely being cleaned by the soldiers of the 37th Engineer Battalion. Labeled Task Force Neighborhood, the civil operation was modeled after similar successful projects in Baghdad. The vacant lots of the city are filled with a variety of garbage—rotting vegetables, old clothes, and animal waste are the most easily identifiable. The rest has turned into a sort of brown and gray compost pile, home for thousands of flies and food for roaming chickens. This is where Task Force Neighborhood works.

The engineers arrive at the makeshift dumps with an escort of soldiers from the 502d Infantry Regiment and an assortment of tools for cleaning: brooms, shovels, garbage bags, and wheelbarrows. The soldiers have two missions when they go out—to clean the neighborhood and to pump money into the Mosul economy. To achieve these missions, they employ Iraqis to help them clean. A psychological operations team accompanies the engineers with a taped message informing local citizens that they can make money helping the soldiers clean the streets. The unit offers Iraqis "two or three dollars to work."

The soldiers and Iraqis have at their disposal handheld tools as well as bulldozers and dump trucks. The bigger equipment takes care of the largest portions of trash, then people with shovels and brooms come in to get refuse in hard-to-reach places. So far Task Force Neighborhood has cleaned two vacant lots, one of which had between 30 and 40 dump truckloads of garbage, and the streets and gutters around a downtown mosque. The trash carted away goes to a landfill about a 40-minute drive southwest of town. The engineers have a long, hard job ahead of them. Cleaning the makeshift dumps takes a lot of effort and time. Besides getting rid of newly made dumps all over Mosul, the engineers also have to work to keep clean the areas they just beautified. One recently cleaned dump already has trash in it.

Specialist Hutcheson is a journalist with the 101st Airborne Division (Air Assault), Fort Campbell, Kentucky, serving in Iraq.

Kazer Bridge Restoration

By Specialist Robert Woodward

During a three-day project, engineers of the 101st Airborne Division spanned the Kazer River, a tributary of the Tigris River, and gave control of the bridges to local officials. The construction effort was part of the stability and support operations the division is conducting in northern Iraq.

The new bridges eased congestion along Highway 2, a main artery between Mosul and Erbil, the two largest cities in northern Iraq. The four-lane highway crossed the Kazer over two bridges, both of which were partly blown up by Iraqi forces during the war. The southern span was only partially destroyed, while the northern bridge was completely disabled. Iraqi traffic continued to use the bridges, leading to a "rather unsafe" condition.

The first day of work began when the sappers of the 326th Engineer Battalion, Fort Campbell, Kentucky, cleared away the collapsed portion of the northern bridge, which leaned precariously on supporting pylons. Careful placement of C-4 plastic explosives would allow the bridge section to fall to the riverbed without striking the pylons, which could cause the rest of the bridge to tumble down. A 25-foot hydraulic excavator was used to move rubble away from the work area and then to raise the engineers up under the bridge to place the charges. Steel pickets and wooden beams were used to wedge explosives into place, and then fuse line was let out 500 meters to the detonation site.

Soldiers of the 310th Psychological Operations Company roamed the area, using loudspeakers mounted on their high-mobility, multipurpose wheeled vehicles (HMMWVs) to instruct gathering villagers in Arabic to move back and take cover. Traffic was blocked from the east and west, and OH-58 Kiowa Warrior helicopters flew over the site, watching for breaches in safety and security.

Crater charges propelled the end of the bridge upward. According to the assistant division engineer, the battalion used more than 1,000 pounds of explosives to knock down the bridge section and didn't do any damage to the nearby villages or harm any people.

The next morning, the 299th Engineer Company of Fort Belvoir, Virginia, prepared to put up a single-lane medium girder bridge made of aluminum and especially designed for quick construction. The unit measured the gap and decided that 16 links of the bridge were needed to span the 34 meters. Soldiers worked in groups, picking up bridge pieces weighing as much as 600 pounds and assembling them. First, the bridging company set up the staging portion of the bridgeworks, which acted as a launching mechanism for the boom of the hydraulic excavator. The boom was extended link by link until it reached the far side. Then the boom was used to support the bridge as it was pushed over the gap by a large truck.

U.S. Army photo by SPC Robert Woodward

Combat engineers of the 326th Engineer Battalion, 101st Airborne Division, prepare a counterforce charge used to blast away a fallen segment of the Kazer Bridge near Mosul, Iraq, 28 April 2003.

Though the bridge was constructed quickly, it's no slapdash structure, but a one-lane bridge that can hold 70 tons. A section from the 74th Engineer Company (Assault Float Bridge), Fort Hood, Texas, arrived and added another lane to the northern bridge using the Army's new dry support bridge. The main advantage in using the dry support bridge is that the launch vehicle does the heavy lifting during construction. Since soldiers did not have to pick up the heavy pieces, it took only eight people to assemble the bridge.

Turning the bridges over to the Iraqi people was one more step toward restoring the economy and security of the region.

Specialist Woodward is a journalist with the 101st Airborne Division (Air Assault), Fort Campbell, Kentucky, serving in Iraq.

ENGINEER UPDATE

Commercial numbers are (573) 563-xxxx and Defense System Network (DSN) numbers are 676-xxxx unless otherwise noted.

TRADOC Systems Manager-Engineer Combat Systems

Wolverine. These systems were fielded to the 299th Engineer Battalion, Fort Hood, Texas, late last year. A third battalion set is scheduled for the 4th Engineer Battalion, Fort Carson, Colorado, in FY04. The last of the Wolverines will be fielded to the 3d Armored Cavalry Regiment at Fort Carson no later than FY05. Many of the vehicles will come from 4th Infantry Division when they go from 12 to 9 Wolverines per battalion. The Project Manager, Abrams Tank Systems manages the Wolverine program.

Airborne Standoff Mine-Detection System (ASTAMIDS). In May, the Project Manager, Close Combat Systems (PM-CCS) awarded a development contract for ASTAMIDS to Northrup Grumman. The ASTAMIDS sensor will also be developed to fill the Army's need for an advanced reconnaissance, surveillance, and target acquisition (RSTA) sensor, capable of target designation. The goal is for this to be the embedded sensor on all larger unmanned aerial vehicles (UAVs).

Ground Standoff Mine-Detection System (GSTAMIDS). Development on the Block 0 (Improved Interim Vehicle-Mounted Mine Detector) program is being terminated. An FCS-based GSTAMIDS program will begin in October.

Handheld Standoff Mine-Detection System (HSTAMIDS). An interim fielding of 200 HSTAMIDSs was completed in February to support Operation Enduring Freedom and Operation Iraqi Freedom. Commanders taking over some of the 200 units in either area of operation need to plan for operator training time. The radar-based HSTAMIDS, which is fundamentally different from metal detectors, requires from 32 to 40 hours of training. Operational testing for HSTAMIDS was conducted in May at Yuma Proving Grounds. Minor design improvements have been identified for incorporation in the full-rate HSTAMIDS production to begin later this year.

Mongoose. This C-130-transportable countermine system is optimized for the Stryker Brigade Combat Team. Its explosive net defeats all mines regardless of fuzing. Flight testing is underway this summer at Yuma Proving Grounds, and fielding is scheduled for FY05.

Intelligent Munition System (IMS). The PM-CCS awarded two contracts for the initial phase of IMS development to General Dynamics and Textron Defense Systems.

POC is Mr. Eric McGrath at *<mcgrathe@wood.army.mil>* or (573) 563-4081/4085. Pictures and briefings are available at the TSM-ECS home page at *<http://www.wood.army.mil/TSM/>*.

● ●

News and Notes

Deployment Teambuilding at the Army Management Staff College. Fifteen soldiers from the 1st Information Operations Command at Fort Belvoir, Virginia, attended a first-ever Deployment Teambuilding session at the Army Management Staff College (AMSC) on 24 July 2003. These soldiers will soon deploy for six months to multiple locations in Iraq.

Why teambuilding? An Information Operations planner at 1st Information Operations Command, who was previously deployed to Kosovo and knew the inherent problems that could develop when integrating a small group of subject matter experts into an already existing staff, searched for a resource that could provide actionable skills on group dynamics. He wanted tools to assist the team members in coordinating, synchronizing, and integrating actions in the information environment of a very diverse group, a multinational coalition, in order to accomplish a common goal.

After finding that there was neither an in-house capability for such training nor a comprehensive Army course catalog, the planner contacted AMSC at *<http://www.amsc.belvoir.army.mil>*. The chairman of the Department of Leadership and Management at AMSC worked with the staff to develop a course that met 1st Information Operations Command requirements. The chairman saw a great opportunity to support soldiers on the battlefield, a goal he says is part of the charter of the sustaining base program.

According to the chief of the 1st Information Operations Command Field Support Division, it is quite unusual for a large Army educational institutional to be flexible enough to react so quickly since the time lapse was only ten days from the initial call to the scheduled class. If all goes well, 1st Information Command will look into the possibility of adding the AMSC course as a regular part of predeployment training for field support teams deploying from Fort Belvoir to support land component commanders worldwide.

POC is Ms. Mary Ann Hodges at *<maryann.hodges@amsc.belvoir.army.mil>* or (703) 805-4766.

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Engineer (ISSN 0046-19890) is prepared quarterly by the U.S. Army Maneuver Support Center, 320 MANSCEN Loop, Suite 210, Fort Leonard Wood, Missouri 65473-8929. Periodicals postage is paid at Fort Leonard Wood, Missouri, and additional mailing offices.

POSTMASTER: Send address changes to U.S. Army Maneuver Support Center, ATTN: ATZT-DT-DS-B *(Engineer)*, 320 MANSCEN Loop, Suite 210, Fort Leonard Wood, Missouri 65473-8929.

CORRESPONDENCE, letters to the editor, manuscripts, photographs, official unit requests to receive copies, and unit address changes should be sent to *Engineer* at the preceding address. Telephone: (573) 563-4104, DSN 676-4104. *Engineer's* e-mail address is *<pbd@wood.army.mil>*. Our Internet home page is located at *<http://www.wood.army.mil/engrmag/emag_hp.htm>.*

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ENGINEER

The Professional Bulletin of Army Engineers

October-December 2003 | Headquarters, Department of the Army | Volume 33 PB 5-03-4

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Front and Back Cover:

Soldiers with the 205th Engineer Battalion fill sandbags and load them onto a truck at Kandahar Army Airfield, Afghanistan, 25 August 2003. Photo by PFC Hugo A. Barry-Vasquez.

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Clear The Way

By Major General R.L. Van Antwerp
Commandant, U.S. Army Engineer School

Now that 2004 is here, we reflect on our accomplishments of the past year. We have activated the largest number of Reserve and Army National Guard soldiers since the Korean War. We helped liberate 23 million people in Iraq and maintain liberation for another 23 million in Afghanistan.

Today in Iraq, almost every city, town, village, and province has a government or a council chosen by and run by local Iraqis. More than 130,000 Iraqi Security Forces are taking responsibility for security for their own country. More than 150 Iraqi newspapers are now in circulation—a free press in that country for the first time in decades. Hospitals, clinics, schools, and universities are open—with an increased load of students. Water, power, and essential services are at or above prewar levels in most of the country. These successes and many more are documented in this issue of *Engineer*.

I am pleased to report that we had a great turnout at the Engineer Warfighter Conference in November, held in conjunction with the Society of American Military Engineers (SAME)/Army Engineer Association (AEA) Regional Meeting in Savannah, Georgia. My thanks go to these two organizations for hosting such a professional event. Thank you also to all who took the time to attend and especially to those of you who made expert presentations. The joint and multinational perspectives brought home the fact that no matter what uniform we wear, we are all engineers with the same skills and challenges. The conference validated the issues associated with initial lessons learned for engineers and has mapped out the way ahead for us. To truly make these lessons "learned," we must find solutions before the next war.

We will continue the progress we made at the Warfighter Conference and give an update to the field at the ENFORCE Conference on 26 - 30 April 2004. The theme for ENFORCE 04 is "Forging Our Future—Shaping Engineers for Joint and Multinational Operations." Many of you have already expressed an interest in attending, hosting a breakout session, or making a presentation to the group. I encourage you to come prepared to share lessons learned with the rest of the Regiment.

During my recent trip to Iraq, I was impressed with the total professionalism of our engineer soldiers. I had the honor of visiting with soldiers and leaders who are making a difference and preserving our freedoms. I am proud of you! Let me close by remembering those in our Regiment we have lost there since the last issue of *Engineer* was published. As we begin this New Year, let us resolve not to forget their ultimate sacrifice. Essayons!

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Captain Christopher Soelzer	5th Engineer Battalion, Fort Leonard Wood, Missouri
Major Christopher Splinter	5th Engineer Battalion, Fort Leonard Wood, Missouri
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Lead The Way

By Command Sergeant Major Clinton J. Pearson
U.S. Army Engineer School

It is indeed an honor to be selected to serve as your Regimental Command Sergeant Major (CSM) and very difficult to express how grateful and blessed I feel. This is a position of *service* to our soldiers, Regiment, and Army and to our great nation. I use the word "serve" because being selected to a nominative leadership position has little to do with the person being selected—but rather how well you have served others, the Army, and the nation. I will continue to serve others as I have for the past 26 years.

I once read a quote that states, "To whom much is given, much is expected." This is true in our profession. I am truly grateful to Major General (MG) Joe Peterson, whose leadership and guidance over the previous two years in the 1st Cavalry Division is sincerely appreciated; MG R.L. Van Antwerp for selecting me; and Brigadier General (BG) William McCoy for embracing me. I thank CSM Bill McDaniel, U.S. Army Maneuver Support Center (MANSCEN), and CSM Michael Balch, U.S. Army Corps of Engineers (USACE), for their unwavering support during my transition from Fort Hood, Texas.

On 26 November 2003, CSM McDaniel and I executed the battle handoff. As I stood among the leadership of the installation and the MANSCEN team, I felt sincerely humbled. The presence of MG Jack Waggoner (Retired), the honorary colonel of the Regiment; CSM Jack Butler (Retired), the honorary CSM; and CSM Robert Dills (Retired), previous USACE CSM, made it more meaningful. I was again reminded that this position is about serving something greater than myself. These gentlemen have given so much to our Regiment and nation and are three superb examples of selfless service.

I charge all leaders to embrace the Regiment's T3s (**Transform the Regiment, Train Soldiers and Leaders,** and **Take Care of the Regiment**). Leaders must lead the Regiment with a vision that is focused on the Army's Future Force as we continue transformation. The key is understanding where the Army is going with transformation, staying abreast of those changes, and ensuring that our engineer forces are where they should be to support any environment. Training the Regiment must remain our top priority. We must continue to produce the most highly trained engineer soldiers in the world. This begins with instilling pride and the Army's core values in initial-entry soldiers. Our noncommissioned officer (NCO) education system (NCOES) must be structured to meet the demands of a fast-paced, challenging, and changing environment. It is important to exploit every opportunity to conduct joint and multicomponent training, bridging the gap with all engineers across the armed services. It is absolutely crucial that engineers in the Reserve Component—approximately 76 percent of our engineer force—receive the same training opportunities as our active force. Training must be tough and conducted in the most realistic environment we can provide. Taking care of the Regiment means equipping soldiers with the most advanced equipment and technology the Army has to offer; ensuring that we have the right people in the right jobs; and placing quality NCOs with coaching, teaching, and training experience at our training base.

We have such NCOs at the 1st Engineer Brigade. I had the privilege of spending a week with CSM Gerald Jones and the CSMs of the 1st Engineer Brigade, visiting each of their training battalions. This is one of the largest (if not the largest) brigades in the Army, responsible for training officers, NCOs, and soldiers of our Regiment. Colonel Paul Kelly, CSM Jones, and their battalions are charged daily with the sacred responsibility of ensuring that soldiers are fully integrated into the Army and Regiment. This team is always seeking ways to improve training and readiness because training remains our top priority. I must say that after the week ended, I was amazed at the professionals in the 1st Engineer Brigade. As I marched alongside soldiers on Day Seven of basic training—with their chests out and arms swinging, singing cadence with such pride in their voices—I was especially proud to be a soldier. I couldn't help but reflect on the new Soldier's Creed (printed on page 62). Being a soldier is the greatest contribution one can make to his country. It is serving something greater than yourself, because you're charged with the protection of an entire nation and a way of life. Be proud to be called a soldier wherever you go.

As we continue our course, we will not forget those soldiers who have given their lives in the defense of our great nation and our way of life. CSM Balch and I recently visited the Regiment's wounded soldiers at Walter Reed Army Medical Center. Although they have injuries far beyond our imagination, their spirits remain intact and indestructible. They are a constant reminder that freedom is not free. I'm very proud of the soldiers serving in harm's way and of the unsung heroes—their families—serving on the home front. My daily prayers are with you. God bless America! Essayons!

Victory Sappers: V Corps/CJTF-7 Engineers in Operation Iraqi Freedom

Part 2: Since the Liberation . . .

By Colonel Gregg F. Martin

Part 1, "The Attack to Baghdad and Beyond . . ." was published in the July-September 2003 issue of Engineer.

> *"Our engineers continue to excel, both in leading the way toward the reconstruction of Iraq and in providing route clearance, force protection, quality-of-life improvements, and troop construction for our deployed Coalition Joint Task Force. They remain flexible, committed, and professional during this challenging campaign."*
>
> *—Major General Walter Wojdakowski*
> *Deputy Commanding General, V (U.S.) Corps/CJTF-7*

With the fall of Baghdad and the collapse of Saddam Hussein's regime in early April 2003, Iraq was liberated. Since then, V Corps and other coalition forces have grown in size and combat power; expanded into and attacked enemy forces throughout the battlespace of Iraq; and conducted humanitarian, civic action, and reconstruction operations simultaneously. The V Corps engineer force of fewer than 4,000 soldiers that attacked into Iraq on 21 March grew to more than 19,000 under Coalition Joint Task Force - 7 (CJTF-7). This engineer force consists of nearly every type of unit within the U.S. Army Engineer Regiment (active duty, National Guard, Reserve, and civilian), as well as engineers from the Marine Corps, Navy, and Air Force and from coalition forces.

With the mission to reconstruct Iraq and win the peace, this powerful engineer force has performed every type of mission in a complex combat environment across hundreds of thousands of square kilometers, to include—

- Combat engineer and infantry missions.
- Construction and repair of infrastructure, base camps, and facilities.
- Fixed and assault float bridging.
- Ground and riverine patrols.
- Topographic/geospatial engineering from the tactical through strategic levels.
- Diving, well-drilling, and fire-fighting missions.
- Electrical-power repair, generation, and distribution.
- Infrastructure assessment, repair, and reconstruction.
- Contract construction and facilities design and management.
- Asphalt, concrete, and crushed stone production.
- Captured enemy ammunition and missile destruction.

This article highlights what the 130th Engineer Brigade and echelon-above-division (EAD) engineers have accomplished since the liberation of Iraq, as well as the leadership and organizational challenges that have been overcome. This article, in conjunction with "130th Engineer Brigade Lessons Learned and Recommendations From Operation Iraqi Freedom" (page 11) captures important lessons which will help the Engineer Regiment and improve the Future Force.

(Note: The role of divisional and echelon-above-corps (EAC) engineers, as well as the U.S. Army Corps of Engineers (USACE) and contractors, each of whom played a major role, is beyond the scope of this article.)

Background

In December 2002, V Corps and the 130th Engineer Brigade were ordered to deploy to Kuwait and prepare for possible combat operations. The brigade deployed in January and February 2003 and in late February finalized the initial EAD engineer task organization to support V Corps's initial maneuver elements, which included the 3d U.S. Infantry Division (3ID) (V Corps main effort) and the 11th Attack Helicopter Regiment (V Corps supporting effort.)

In March, the 130th conducted rehearsals, prepared for combat, and helped supervise the reduction of the Kuwait-Iraq border obstacle complex. On 21 March, the 130th crossed the line of departure in support of V Corps in the liberation of Iraq. V Corps attacked up the southwest side of the Euphrates River past An Nasiryah, through As Samawa, and on to An Najaf, while the 1st Marine Expeditionary Force (1MEF) attacked along the Euphrates River to An Nasiryah, north to Al Kut, and then along the eastern side of the Tigris River. Fighting a tough and determined enemy, V Corps secured its lines of communication and continued to build combat power

The Minnesota National Guard's 142d Engineer Battalion places concrete for a high-voltage power plant at LSA Anaconda in Balad, Iraq.

at Logistics Support Areas (LSAs) Cedar in the vicinity of An Nasiryah and Bushmaster in the vicinity of An Najaf, as it prepared for the final attack on Baghdad.

Near the end of March, the 101st Airborne Division (Air Assault) and the 82d Airborne Division (-) joined the attack, conducting major military operations in urban terrain, which relieved pressure on the main effort (3ID). This enabled 3ID to launch the final push through the Karbala Gap on 3 April, attack over the Euphrates River, complete the destruction of the Medina Republican Guard Division, and seize objectives south and west of the city of Baghdad—to include Baghdad International Airport. Simultaneously, 1MEF was pushing into objectives southeast and east of Baghdad. Within a few days, V Corps and 1MEF forces were executing "thunder runs" throughout Baghdad.

Before the enemy could mount an effective defense, V Corps and 1MEF had won the much-anticipated "Battle for Baghdad." The shock and speed of U.S. military power, combined with the courage and leadership of our ground forces, overwhelmed the enemy. With this new freedom came a vacuum in power and authority as the regime's surviving army and police forces collapsed or melted away.

By late April, V Corps had gained the 4th Infantry Division and 3d Armored Cavalry Regiment and controlled the northern 60 percent of Iraq; 1MEF and United Kingdom forces controlled the southern 40 percent. In May, the 1st Armored Division moved into Baghdad and completed a relief in place with 3ID.

In May, V Corps learned that it would form the nucleus of CJTF-7, which would stand up on 15 June. In addition, an enormous EAD engineer force had arrived in Kuwait (to supplement the engineers already in place) and completed reception, staging, onward-movement, and integration (RSOI), and its members were either in Iraq or preparing to move north for subsequent operations.

Task Organization

By June, the V Corps (and subsequently CJTF-7) engineer force had increased to 19,000 soldiers (6,000 divisional engineers and 13,000 EAD engineers) organized into 3 brigades, 6 groups, 36 battalions, 21 numbered companies, and 28 detachments. (Note: These figures do not include coalition engineers embedded inside the multinational divisions; joint engineers from the Marines, Navy, or Air Force; or EAC engineers under the 416th Engineer Command or Coalition Forces Land Component Command (CFLCC).

Depending on mission requirements and the tactical situation, which fluctuated over time, each division ultimately received an EAD package that generally consisted of a group headquarters; 1 or 2 corps combat battalions; 1, 2, or even 3 combat heavy battalions; 1 or more multirole bridge companies; an additional construction company (combat heavy or combat support equipment [CSE]); a utilities detachment; a facilities engineer team (FET) or portion of a facilities engineer detachment (FED); and a fire-fighting detachment. Well drillers, divers,

Prime power soldiers from the 249th Engineer Battalion prepare wiring for a branch circuit to refrigerate Army and Air Force Exchange Service storage containers.

and topographic, bridging, and prime power soldiers, as well as USACE Forward Engineer Support Teams (FESTs) were also provided on an as-needed basis.

Although the size and composition of the 130th Engineer Brigade has changed, a typical snapshot from June to September revealed a unit composed of approximately 6,500 to 7,000 soldiers organized into 3 groups; 5 combat heavy battalions; 2 corps wheeled battalions; 2 corps mechanized battalions; a bridge battalion with an assault float bridge company and a medium girder bridge company; a Korean battalion (plus a Republic of Korea army medical company); 3 combat support equipment companies; 3 multirole bridge companies; a construction support company; a prime power company; a topographic engineer company; and numerous detachments and teams, including utilities, fire-fighting, diving, well-drilling, FETs, FEDs, and FESTs.

Operating throughout Iraq since the end of the ground offensive, this robust, multifunctional brigade has executed more than 3,000 missions, focused on V Corps and CJTF-7 priorities, and backstopped every division and major subordinate command (MSC) on a wide variety of missions.

(Note: Always adapting to meet the needs of the battlefield and providing the best possible engineer support, several of the above-mentioned units have since been moved to maneuver units.)

Missions, Priorities, and Commander's Guidance

Missions

Once maneuver forces had secured their areas of operations, the priority of engineer effort was to provide mobility, survivability, and general engineering support to V Corps forces to allow the Iraqis to rebuild their nation, establish a stable government, and develop a peaceful, prosperous society. Reconstruction of civil infrastructure and humanitarian construction in support of the Iraqi people were to be accomplished by civilian contractors under the supervision of the coalition's Office of Reconstruction and Humanitarian Assistance (ORHA). The original plan was for military engineers to focus almost exclusively on support to V Corps and coalition forces. The 130th was to provide humanitarian engineering only under emergency circumstances. Contractors were to take on as much work as possible to regenerate the economy, put people back to work, and rebuild the country. (Note: The USACE-led Task Forces Fajir [New Light] and Restore Iraqi Oil [RIO] were already well under way to restoring Iraqi electrical power and oil, using a combination of USACE and Iraqi expertise and civilian contractors.)

The 3ID engineer team, working in Baghdad since the collapse of the regime in early April, was already responding to the urgent situation and was performing extensive civil and humanitarian construction. By late April and early May, after V Corps forces had expanded into the battlespace of northern and western Iraq, the dire straits of the Iraqi people and their dilapidated infrastructure became more apparent. Soon, military engineers were called on to provide emergency assessments, construction, and repairs. By 12 May, it became clear that the situation demanded a focused emergency response. Military engineering resources were diverted to immediate civil requirements as civilian engineer contractors were unable to respond to demands. With the original Task Force Neighborhood in Baghdad—a concept conceived by the V Corps commander and assigned to the 130th Engineer Brigade for planning and execution—military engineers leaped fully into the fray of civil-military operations and humanitarian construction. This concept rapidly expanded to maneuver and engineer units throughout Iraq. By mid-May, V Corps engineers were fully engaged in both military engineering in support of V Corps forces and humanitarian/civil-military engineering operations in support of the Iraqi people and society.

Standing Up the C-7. Upon learning that V Corps would form the nucleus of the new CJTF-7, the 130th Engineer Brigade and the V Corps staff engineer section went to work planning, sourcing, and standing up the new CJTF-7 staff engineer section (C-7)—a 55-person coalition-joint staff that would take over engineer staff planning and coordination from the 18-person V Corps staff engineer section. This enormous planning, leadership, and logistical challenge was made even more difficult because it was accomplished in the midst of RSOI, combat, and stability operations. With "cover-down" personnel from both V Corps and CFLCC to temporarily fill the joint manning document, the new C-7 officially took over the engineer fight in Iraq on 15 June.

The C-7 immediately faced three strategically critical missions: providing facilities for the new Iraqi army, bedding down and constructing operational infrastructure for coalition forces, and destroying captured enemy ammunition. Taking into account the relative strengths of troop units, USACE, and contractors, the C-7—in conjunction with the other elements of the CJTF-7 engineer team—developed innovative solutions for these missions. Next, C-7 needed to rapidly increase electrical power production throughout Iraq to make an immediate positive impact on the lives of the Iraqi people. The solution was to form "Task Force 4400," which put coalition military engineers into Iraqi power plants to improve management and operation, expedite repairs, and quickly increase power production across the nation to 4,400 megawatts.

Transitioning to a Theater Army Engineer Brigade. Simultaneously, the 130th Engineer Brigade became the de facto theater Army engineer brigade (TAEB) in Iraq. Manned and trained to perform as V Corps's combat engineer brigade, the 130th had to stretch itself physically, mentally, organizationally, and doctrinally to effectively perform this new role. Adding to the challenge was the need to staff three command posts: a rear command post in Kuwait to command and control the RSOI of incoming EAD forces; the brigade main command post at the V Corps logistics and air hub in north-central Iraq; and the brigade tactical command post in Baghdad, where it played a key role in standing up the new C-7. Although the 130th was transitioning to a TAEB, it was still fulfilling its primary mission of supporting V Corps's MSCs throughout Iraq.

Exacerbating the situation was the requirement to send the 130th Engineer Brigade deputy commander to work as the V Corps engineer at ORHA in downtown Baghdad. Supplementing and reinforcing ORHA and then the Coalition Provisional Authority (CPA) was critical to the planning, funding, and execution of both civilian and military engineering programs in Iraq. His experience in both USACE and joint engineering operations made him ideal for these key strategic roles, where he has made a valuable contribution.

Fortunately, the commander of the 18th TAEB dispatched one of his key lieutenant colonels to be the new deputy commander of the 130th. Having just served as the operations officer of the 18th TAEB, where he planned and developed military infrastructure for the northern option, the new deputy commander brought his organizational expertise to the fight in Iraq. Arriving in late June and serving as the deputy commander for 101 days, he helped recast the 130th from a combat-focused corps engineer brigade to a construction-focused TAEB.

The 565th Engineer Battalion patrols the Tigris River at Tikrit, Iraq.

A soldier from the 320th Engineer Company (Corps) (Topographic) uses an automated integrated survey instrument at LSA Anaconda.

Cooperating with the C-7, the 130th Engineer Brigade played a key role in fulfilling several major functions which went beyond its doctrinal mission. (Note: Several of these functions were ultimately taken over by the C-7.)

- Engineer oversight and construction/design support to theater/CJTF-7 enduring bases.
- Execution of the theater/CJTF-7 construction program.
- Engineer reinforcing support to the MSCs for master planning, design, and assessments; oversight of Class IV supplies; and direct support when MSC engineering requirements exceeded their capabilities.
- Assistance to the C-7 in theater engineer planning, force structure management, and personnel.
- Establishment of a theater bridge park.

The 130th Engineer Brigade faced the following challenges:

- It was a corps combat brigade now cast in the role of a TAEB.
- It did not have an organic construction management section (CMS) comparable to the robust 36-person CMS in a TAEB. (Note: The 130th does have a small CMS element which will return to the 18th Engineer Brigade, from which it came about a decade ago.)
- With the stand-up of the C-7, the 130th lost its organic staff engineer section, which became the nucleus of the C-7.
- Of the engineer groups assigned to the 130th for command and control of construction in Iraq, two are combat groups with no CMS, and the one construction group has very few personnel with engineering degrees. This reinforced the need for a strong CMS in the 130th.
- Development of LSA Anaconda was the largest construction mission in Iraq, but the assigned FET was not resourced adequately for such a huge mission.
- Division engineer brigades and combat engineer groups throughout Iraq are not staffed to manage large construction missions, which means the 130th must be prepared to backstop the construction program throughout the theater, as required.
- There was no theaterwide plan to provide quality assurance for contract construction in support of coalition forces, so the 130th must be prepared to backstop this effort.

To accomplish its mission as TAEB, the 130th Engineer Brigade made the following organizational adjustments:

- Relocated and embedded a portion of a FED into the 130th staff and combined it with the remnants of the 130th CMS to perform the functions of the TAEB's "missing CMS."
- Relocated the V Corps FEST from the C-7 and aligned it under the 130th CMS.
- Created a 16-person 130th CMS that, in cooperation with the C-7, performed construction management at the CJTF-7 enduring base camps; provided master planning, design, assessments, and contract facilitation to theater enduring base camps; managed Class IV supplies; and provided reinforcing support throughout Iraq to the C-7 and MSCs.

130th Engineer Brigade Commander Priorities

In July, after "sprinting" for six months through the deployment, preparation for combat, ground offensive, movement into the Iraqi battlespace, and stand-up of the C-7, the one-year tour length for Operation Iraqi Freedom was announced. It became clear we could not function effectively without developing a way to accomplish the mission, train, maintain, take care of people, and sustain ourselves for the long haul. Since we were conducting combat operations but also were conducting many of our functions in a garrison-like environment, I directed the 130th Engineer Brigade staff to develop standard operating procedures (SOPs) that described how we would do business in Operation Iraqi Freedom, an environment in which neither our field SOP nor our garrison SOP applied neatly.

Simultaneously, I reviewed my command philosophy, which was published in June 2002 after taking command of the 130th Engineer Brigade in Germany. My intent was to make sure that the vision laid out during peacetime in Europe still applied for the brigade at war in Iraq. I did not change a word, because it still applies to what we are doing:

- People are our essence. Care for, develop, and inspire them.
- Training is the glue that holds us together. Focus on the basics of "shoot, move, communicate, and survive" at individual, crew, and squad levels to ensure that our soldiers stay alive to accomplish the mission and get home safely when the time comes.
- Maintenance of equipment and people will sustain us over time and enable us to accomplish the mission.
- All of this must be encased under the overarching umbrella of discipline, safety, and force protection.

Commander's Guidance

With enormous demand for engineers but only limited resources, I established a priority of engineer effort that met the CJTF-7 commander's intent and guidance:

- Provide coalition forces with mobility, survivability, and general engineering support during military operations to create a safe and secure environment.
- Provide force protection and beddown construction to protect our soldiers and provide a decent quality of life (at a minimum: out of the dirt, environmental control units, toilets, and showers.)
- Support CPA and Iraqi people with civil infrastructure, humanitarian civic action, and Task Force Neighborhood missions.
- Train to survive on the battlefield. We can afford to lose a day on a project to ensure that our soldiers are prepared for the challenges and dangers they face daily.
- Do "good things" to help coalition forces and the Iraqi people. Let's work ourselves out of a job.
- Ensure that engineers are gainfully employed at all times—no idle engineers.
- Respond immediately to 911 calls. Be flexible and ready to respond. We are at war!
- Perform other missions as needed.

Subordinate commanders were instructed to develop a sustainable operational tempo which would ensure mission accomplishment while building better, stronger, more motivated soldiers and units that would be better and more inspired when they departed Iraq than when they arrived in theater. We enhanced our daily communications rhythm of battle update briefs, staff updates, and engineer video teleconferences with weekly maintenance conferences; biweekly planning and operations conferences; and monthly commanders conferences, training briefs, and unit status reports. The intent was to enhance our communications, connectivity, and future planning. In addition, my specific guidance to everyone in the brigade was as follows:

- We will be in Iraq for a full year. This is a grueling and dangerous "ultramarathon." Plan accordingly.
- Reestablish predictability and retain the ability to respond immediately to "hot missions" and 911 calls.
- Establish the proper balance between the mission and people/training/maintenance/supply, and emphasize the human dimensions of job/mind/body/spirit/family/friends.
- Learn continuously and grow as a professional each day.
- Encourage everyone to "sharpen the ax" and "recharge batteries" each day.
- Get enough rest, eat a healthy diet, work out, and maintain personal hygiene.
- Strive to take one day off each week, and when it makes sense, take leave or rest and relaxation.
- Support the chaplains' programs and help inspire soldiers to maximize their time in Iraq and on earth.
- Make time for physical training and sports and social events such as movie nights, karaoke nights, and soldier talent shows. Make this year in Iraq the ultimate soldier and life experience.
- Make a positive difference every day. Help others. Be a good person and friend.
- Stay positive and enthusiastic, and maintain an "attitude of gratitude" in all circumstances.
- Have fun, and enjoy each day. This is important in a combat zone, where any day could be your last.

Leaders relentlessly communicated, enforced, and tried to live this philosophy every day, while encouraging subordinates to follow suit.

Major Achievements

Since the liberation and end of major combat operations, the 130th Engineer Brigade has contributed to Operation Iraqi Freedom by completing more than 3,000 missions in support of CJTF-7, MSCs, CPA, and the Iraqis, to include the following highlights:

- Provided combat, construction, topographic, design, prime power, infrastructure assessment, bridging, riverine, firefighting, and diving support throughout Iraq.
- Planned and executed the original Task Force Neighborhood missions in Baghdad.
- Planned, organized, and stood up the C-7 for CJTF-7. Continues to provide a nucleus of personnel for this vital and successful staff section.

- Developed the prisoner holding areas, interrogation facilities, helipad, and coalition base camp for the Baghdad Central Confinement Facility.
- Planned, designed, and constructed the largest CJTF-7 base camp (LSA Anaconda) and repaired the heavily damaged airfield by placing more than 8,000 cubic meters of concrete.
- Provided construction support to both ORHA and CPA.
- Delivered and installed a 20-megawatt power plant at the Basra oil refinery, averting widespread rioting.
- Worked with Iraqis to repair high-tension electrical power lines in support of CPA.
- Upgraded a 100-kilometer stretch of Highway 1 in southern Iraq so it could serve as a safe main supply route.
- Reduced hundreds of kilometers of berms and fighting positions throughout Iraq that were potential ambush sites.
- Hauled tons of captured enemy ammunition to secure sites for destruction.
- Planned, coordinated, and provided command and control of Task Force Rocketeer, in which the 130th helped secure and destroy dozens of surface-to-air missiles throughout Iraq.
- Planned and executed more than 100 humanitarian and civic action projects throughout Iraq, to include the renovation of schools, health clinics, playgrounds, and sports facilities.
- Assigned units planned, executed, and managed nearly $900 million worth of contractor or contractor-equivalent construction. (Note: The 937th Engineer Group's facilities program for the new Iraqi army is valued at $800 million.)
- Trained forces on the South African Interim Vehicle-Mounted Mine-Detection System (IVMMDS) and developed combined arms tactics, techniques, and procedures to use this system to detect and neutralize enemy mines and improvised explosive devices (IEDs).
- Developed Task Force Right of Way, using the IVMMDS, sappers, and earthmoving equipment to detect and neutralize IEDs along main supply routes. Established a training academy and exported this concept to MSCs.
- Trained forces for the new Iraqi Civil Defense Corps in support of the Ukrainian brigade of the Polish-led multinational division in south-central Iraq.

Conclusion

The Victory Sappers of V Corps and CJTF-7 built a cohesive, motivated, multifunctional engineer team of more than 19,000 active duty, Reserve, and National Guard soldiers and civilians from all four Army corps, comprising every facet of the U.S. Army Engineer Regiment. This dynamic team has executed thousands of missions of every type over hundreds of thousands of square kilometers. It has incorporated joint and coalition engineers into the team as it continues to assure the mobility, survivability, and force beddown of first V Corps and now CJTF-7. The Victory Sappers "engineered the victory" during the ground offensive and have played a critical and larger-than-expected role in rebuilding Iraqi infrastructure. The Victory Sappers continue to play a key role in support of coalition efforts to win the peace and build a stable and prosperous Iraq.

Members of the 130th Engineer Brigade are grateful for the privilege of serving in Operation Iraqi Freedom. No matter how tough the situation, we have chosen to have "an attitude of gratitude" in all circumstances. We are thankful and proud to be engineers and are committed to ensuring victory. We hope that our experiences, lessons learned, and recommendations are beneficial to the Engineer Regiment and the Army so that we improve the Future Force.

Colonel Martin has served as commander of the 130th Engineer Brigade and as V Corps engineer since June 2002. After deploying to Kuwait, he led the brigade's attack on Day One of the ground offensive and has served in Iraq since. He also served as the CJTF-7 director of engineering C-7, responsible for standing up a coalition-joint engineer staff. Previous assignments include command of the "Fightin' 5th" Engineer Battalion, service with Joint Task Force Bravo in Honduras, and teaching at West Point and the Army War College. A graduate of the U.S. Military Academy, the Army and Naval War Colleges, and the Massachusetts Institute of Technology, he holds a Ph.D. in construction engineering management and public policy.

Photos by Jayme Loppnow, 130th Engineer Brigade Public Affairs.

The author would like to thank the following people:

- Those great Americans and allies who shed their blood or gave their lives to free Iraq.
- The soldiers and civilians of the 130th Engineer Brigade, V Corps, and CJTF-7 who put their lives on the line to liberate Iraq and win the peace; and the superb leaders of the 130th Engineer Brigade, V Corps staff engineer section, CJTF-7 C-7, and MSC engineer units who planned, coordinated, and fought the engineer fight.
- Every member of the worldwide engineer team—military, civilian, and contractor—who had a role in fielding, training, deploying, supporting, and fighting with the Engineer Regiment in Operation Iraqi Freedom.
- Members of the 130th Engineer Brigade who provided ideas, input, and comments for this article.

(Note: For more information on the 130th Engineer Brigade, after-action reviews, SOPs, articles, and photos, see the 130th Engineer Brigade Web sites at NIPRNET *<http://www.130thengineers.army.mil>* or SIPRNET *<148.35.87.68>*.)

130th Engineer Brigade Lessons Learned and Recommendations From Operation Iraqi Freedom

By Colonel Gregg F. Martin

Using the Training and Doctrine Command's (TRADOC's) doctrine, organization, training, materiel, leader development, personnel, and facilities (DOTMLPF) format, this information is divided into strengths that should be sustained and areas of concern that should be improved.

Doctrine

Sustain

- We needed and received many EAD engineers, but we needed them earlier in the force flow.
- The military decision-making process works. Teach and use these concepts, along with ways to modify them on the fly in combat.
- The assured mobility concept is sound. Continue to develop and teach it.
- Aggressive, rapid execution works. Teach "A partial solution now!" and ways to tailor and employ flexible mission modules in combat.
- Active and Reserve Component integration worked. Teach leaders how to build a cohesive team in combat. Build on this success.
- Units simultaneously commanded and controlled deployment, RSOI, high- and low-intensity conflict, stability operations, and support operations. Understand how this was done, and continue to develop this flexibility in our leaders.
- The adaptability and flexibility of engineers in rapidly executing numerous nondoctrinal missions was excellent. Build on this success.
- The ability to task-organize to tailor the right mix of skills and forces for the mission was a success.
- The integration of hard-skilled USACE engineers into the fight worked well.

Improve

- We must do a better job of "telling the engineer story" to the Iraqi, American, and world media. Public affairs and information operations are fundamental and must be an integral part of the plan and campaign—not a nice-to-do add-on. The entire force needs extensive education, training, and organizational adjustment to improve in this strategically crucial pillar of modern warfare.
- We must understand the proper use of command and support relationships. Leaders must resist the urge to assign "units to missions" and must instead assign "missions to units," especially in stability operations and support operations.
- Engineers are flexible and possess a "can-do" spirit. However, leaders must resist the urge to use them for everything because we quickly run out of engineers and do not have them available to perform critical engineer missions, especially during stability operations and support operations.
- We need to better understand and teach "how-to-fight" combat heavy battalions, CSE companies, multirole bridge companies, FEDs, FETs, FEST-As, etc.
- The transition from the ground offensive to stability operations and support operations was very challenging. We need to understand, teach, and plan this better.
- Construction contractors did not deliver as much or as quickly as planned and expected. Troops must be ready to go it alone with little contract construction support for a long time in an austere and dangerous environment. We need to use host-nation engineer capabilities as much as possible.

Organizations

Sustain

- Combat heavy battalions, CSE companies, and corps wheeled battalions provide powerful, multifunctional capabilities. We need more of these units in the Active Component.
- All engineer headquarters—brigade, group, and battalion—are huge force multipliers. We need to embed or plug in key enablers such as a CMS, civil affairs, linguists, and contracting, especially for stability operations and support operations.
- The O-6 division engineer brigade headquarters has been a huge force multiplier in all phases of the campaign. We must retain these in the heavy divisions.
- Always attach separate companies and detachments to a battalion, which provides "family, love, and discipline." When this did not happen, we had problems.
- The FEST-As were a huge success in terms of reachback and technical expertise. We need to resource and fund one per corps, division, and armored cavalry regiment. We should embed this in organization and doctrine.
- Employment of the 1138th Engineer Battalion headquarters (Missouri Army National Guard) as the V Corps/CJTF-7 Mine Explosive Ordnance Information Command Center was a success. It resulted in a superb "fusion center" for information and analysis of enemy mines and explosive threats.

Improve

- A TAEB or engineer command would have been ideal for the enormous engineer mission in Iraq, especially after the ground offensive. At a minimum, the equivalent CMS and contracting capability should have been provided to the corps combat brigade.
- The optimal task organization evolves over time but is very hard to change, especially if it means taking units away from an MSC. We need to plan and agree in advance on solid disengagement and change criteria for task-organization transitions.
- Leaders need a better understanding and appreciation of low-density engineer units such as prime power platoons, multirole bridge companies and utility detachments, as well

as well drillers, divers, firefighters, FETs, FEDs, and FESTs. Their capabilities must be introduced in professional military education, and the leaders of these units must go to warfighter and other training exercises in order to educate the force through seminars and discussion.

- We need to develop multifunctional EAD engineer battalions that combine combat, construction, and bridging capabilities.
- Quarrying, rock-crushing, and paving capabilities are needed in Active Component combat heavy battalions.
- The Army should officially recognize and staff the 565th Engineer Battalion (Provisional) headquarters and make it our expert bridging unit. The 565th played a crucial role in Operation Iraqi Freedom, because it planned and constructed assault float bridges, medium girder bridges, and Mabey-Johnson bridges throughout Iraq. Other than the 565th, there are no centers of expertise on the proper employment of tactical bridges. The 565th could fill this role.
- We must better educate leaders to resist the urge to break up and farm out the elements of combat heavy battalions to such a degree that we diminish the huge impact they can make on the battlefield. The potential effects of massing EAD engineers—especially in stability operations and support operations—is greatly diminished when they are piecemealed out.
- Every O-6 engineer headquarters needs a construction management capability on its staff. Habitual training associations with FEDs, FETs, or FESTs could fulfill this role.

Training

Sustain

- Our training philosophy was validated in Operation Iraqi Freedom. Focus on the basics. Train better on less.
- Topographic engineering was a huge success. Build on what we have, and continue to improve our topographic training, organization, materiel, and doctrine. This is a huge force multiplier.
- The development of flexible, adaptive, innovative leaders and soldiers was a success. All engineers must be trained on basic infantry and engineer skills. All engineer leaders must understand maneuver and combined arms operations, as well as the fundamentals of combat engineering and construction management.
- We continued to train on the threat and enemy situation as they evolved, with weapons ranges, live fires, mounted live fires on the move, situational training exercises that reflect the reality of the threats in Iraq, combat first aid, tactical convoy procedures, reaction to enemy contact and ambushes, and communications procedures. This was critical to soldier readiness and morale, mission accomplishment, and protecting our troops.
- Mobile training teams from the U.S. Army Engineer School were highly beneficial.

Improve

- Engineer Qualification Tables, training programs of instruction, and mission-essential task lists must include stability operations and support operations in a hostile environment. Examples are convoy operations, ambushes, IEDs, and mounted gunnery.
- Education and training of leaders for postconflict stability operations and support operations should include topics such as contracting, language and cultural knowledge, employment of local workers, and use of local materials and building techniques.
- All Army units need a simple, self-help construction program for nonengineers so their units can quickly enhance their own quality of life with tent floors, basic wiring, burn-out latrines, and field showers. A booklet with simple drawings, instructions, and bills of materials should be developed and issued Armywide. This will allow engineers to focus time and effort on more complex engineer missions.

Materiel

Sustain

- TeleEngineering Toolkits were extremely valuable. We need to distribute them down to the battalion level.
- D9 dozers provided a powerful capability throughout the campaign, and the M1 Panther was also useful. Program and field this equipment with dedicated heavy equipment transports, communications, and weapons.
- The hydraulic excavator (HYEX) or trackhoe and Bobcat® skid steer were big winners.
- The South African IVMMDS was valuable for both counter-IED and countermine operations.
- Continue to use blanket purchase agreements, prime vendors, International Merchant Purchasing Authorization Cards (IMPACs), and local construction materials.

Improve

- Develop and procure a technology to detect and neutralize explosive hazards at a safe standoff distance. Given the threat of IEDs, mines, and ambushes, this is the single most important thing that needs to be improved with the greatest sense of urgency.
- Logistics should be simpler and more responsive. Pre-positioned stocks of engineer supplies would make engineers far more responsive and effective.
- Rebuild or replace old engineer equipment such as the M113 armored personnel carriers, armored vehicle-launched bridges, bucket loaders, water distributors, and small emplacement excavators. Of note, water distributors are absolutely essential for construction in the desert.
- Standardize force protection gear for all soldiers and equipment, such as weapons mounts, improved body armor, Kevlar® blankets, improved armor for high-mobility, multipurpose wheeled vehicles (HMMWVs), and more crew-served weapons.
- Develop and fund a secure cellular telephone system for use on the battlefield. All units should deploy with satellite nonsecure Internet protocol router (NIPR) systems for reliable official communications and morale, welfare, and recreation support.

- All military equipment needs to be dual voltage.
- National Guard units must deploy with IMPACs and pre-purchased spare parts (prescribed load list [PLL] and authorized stockage list [ASL]).

Leader Development

Sustain

- Strong, positive, caring leadership works. We validated our philosophy of leadership in training, deployment, preparation for combat, combat operations, stability operations, and support operations.
- A clear mission, task and purpose, and commander's intent are critical; then power down and let folks amaze you. Keep teaching and rewarding this.
- Commanders must be forward and present on the battlefield. Figure out the critical missions and locations, and then go there.
- There is no substitute for "eyes-on" and face-to-face communications, especially in combat.
- Many leaders developed and nurtured strong and productive relationships with Iraqi civil leaders. This must be encouraged, taught, and expanded in the future.
- The Army grows and selects great battalion commanders.
- Leaders must take care of themselves with rest, food, water, hygiene, and time to recharge their batteries. Otherwise, they burn out.
- One-year tours are like an ultramarathon. Leaders must establish a pace to finish the race strong. Balancing mental, physical, spiritual, and social needs is key to thriving in a grueling and dangerous environment. Mission comes first, but strive to make time for training, maintenance, and officer and noncommissioned officer professional development, as well as physical training, chapel, sports, and events such as movie nights, karaoke nights, and soldier talent shows. Leaders must make time for fun! They must grow better leaders and build a stronger team every day. Balance is key to sustaining the force today in Iraq, as well as over the long term for the future.

Improve

- All engineers must be builders. Basic and career course curriculums must ensure that engineer leaders are prepared to build.
- Engineer officers need more knowledge in contracting and facilities management, as well as civil affairs, culture, and language, especially during stability operations and support operations.
- Work to develop even smarter, more flexible, adaptive, and determined leaders who are comfortable in a volatile, uncertain, complex, ambiguous, and dangerous environment. Never assume that engineers will perform only "engineer missions."
- Leaders (especially at engineer group/brigade level and above) need a better understanding of low-density EAD units, such as FEST-As, FEDs, FETs, utility detachments, prime power platoons, firefighters, divers, and well drillers.
- While deployed, fill empty Reserve Component platoon leader slots with excess Active Component lieutenants.
- Leaders need to better prepare themselves and their troops for extended deployments of one year or more. This is a leadership challenge.

Personnel

Sustain

- Our people are everything. Most of our leaders understand and live this.
- Engineer enthusiasm and can-do spirit, along with initiative, flexibility, adaptability, dedication, professional expertise, and team spirit were hallmarks of the campaign.
- Engineers displayed raw courage and bravery every day, all over Iraq.

Improve

- Manage and pay better attention to low-density units from the start.
- Keep unit integrity during deployments.
- Fix the Reserve Component replacement system; they received no replacements during Operation Iraqi Freedom.
- Many units were not filled to authorized strength before deployment. Strive to meet authorized manning levels.
- Management and rotation of captains is out of sync with the needs of the field. New career course captains serve on brigade and corps staffs before getting company command. Once branch-qualified, they immediately depart the theater and cannot be used on brigade- or corps-level staffs, where their expertise is sorely needed.

Facilities

Sustain

- We did a good job of using captured Iraqi facilities, as well as tapping into and developing Iraqi construction capability.

Improve

- Before the fight, we must develop a comprehensive strategic plan for postconflict engineering, base camps, and force beddown. Simultaneously, we must streamline and expedite approval and funding of contingency military construction projects.
- Engineers are expected to be the experts on all aspects of infrastructure, to include civil, military, and captured enemy facilities. They need more training in these areas, as well as in facilities and contract management.
- We need clear legal rules early on regarding the purchase and/or construction of beddown facilities such as containers and trailers.
- We must develop, procure, and deliver Force Provider packages for deploying units.
- FEST, FED, FET, and prime power representatives must be present during the early phases of planning and on the ground early, located forward with the units they will support.

Force Protection of Forward Operating Bases in Baghdad

By Captain Jason M. Railsback

As the 16th Engineer Battalion arrived on the ground in Baghdad, Iraq, the No. 1 priority for all units was force protection. Units under 1st Brigade, 1st Armored Division, occupied central Baghdad east of the Tigris River. The major challenge facing units in the heart of the densely populated city was finding suitable and defendable terrain for forward operating bases (FOBs). This article reflects the impressions and experiences of a mechanized combat engineer company commander. It also describes the engineer mission three months into the deployment. Before deploying to the U.S. Central Command area of responsibility, our unit was unsure if we were going into high-intensity conflict (HIC), stability operations, or support operations. As it turned out, we are supporting all three. This article provides the military engineering community—particularly lieutenants and captains—some practical tactics, techniques, and procedures (TTP) used during Operation Iraqi Freedom and shows the flexibility required to accomplish the many nontraditional missions.

Task Organization

Charlie Company, 16th Engineer Battalion, is a mechanized combat engineer line company with a standard modified table of organization and equipment (MTOE). With the available resources, stability operations and support operations are challenging but not impossible. The company did not task-organize in support of a task force as we typically execute during HIC training. We remained under the command and control of the engineer battalion. Missions in this theater typically require a platoon-sized element. Remaining under the engineer battalion allowed the company to work throughout the area and support all task forces under the brigade combat team. On several occasions, missions required an operational control (OPCON) relationship of engineer squads and platoons to the maneuver company teams for support during raids and listening post/observation post execution.

The most valuable resource we have is our M998 high-mobility, multipurpose wheeled vehicles (HMMWVs). To move quickly and effectively in an urban setting, HMMWVs are critical. M113 armored personnel carriers (APCs) provide better force protection and make a more forceful presence, but with narrow streets, congested traffic, and low-hanging power lines, the HMMWVs provide better mobility and flexibility. We were supported by National Guard and Reserve combat engineers with dump trucks, bucket loaders, wheeled cranes, and additional HMMWVs. On many missions, these OPCON units proved invaluable due to their lifting and hauling capabilities and because they augmented our force protection strength. Because of the threats of ambushes and improvised explosive devices, the 1st Armored Division requires that convoys have a minimum of two vehicles with at least two crew-served weapon systems. As the threat and associated force protection levels changed, some convoys required three or more vehicles. This made it very difficult to execute concurrent missions. Even though our current MTOE does not support it, units on a stability operations and support operations deployment need an increase of at least two HMMWVs per platoon. Even with the additional support from outside military units, many missions still require host nation support.

Contracting and Host Nation Support

A great deal of the manpower and equipment resourcing in Baghdad is contracted though local businesses. There are many difficulties. In addition to the language barrier, there are problems with paying for services, ensuring that the service quality is acceptable, and ensuring that the job is completed on time. The first step in contracting is linking the right contractor to the job requirements. Once the contractor is selected, you must escort him to the job site and allow him to make an estimate. After an agreement on the payment has been reached, the battalion must find resources for the project. If the project is for an FOB, the funds come from a battalion-level field ordering officer. If the project is outside of an FOB (to improve Iraqi public services or for emergencies), the funding is from the brigade commander's Emergency Response Program fund. All other contracts are submitted though the division resource manager, who will approve the overall project and forward it to the contracting office. Contracting receives bids from local contractors and selects the contractor. Once the price is agreed upon and the funding is obtained, the local national contractor begins work. The engineer company's responsibility is to report the progress of the project and ensure that standards are maintained. Once the project is completed, the company will revisit the site, ensure that all the work was completed to standard, and arrange payment for the contractor.

Location

Charlie Company was responsible for FOBs in the oldest and most built-up urban areas of Baghdad, east of the Tigris River. Units either occupied the previous unit's structures or established new ones. The various facilities included one of Saddam's palaces, an amusement park on an island, a bank, and many government ministry buildings. Providing adequate force protection in these areas was challenging.

Military vehicle selection for missions depends on the time of day and the area. The HMMWV is optimal to maneuver in downtown Baghdad, compared to the alternative—the M113 APC. During the day, the streets are virtually impassable in certain areas. Streets designed to handle four lanes of traffic are narrowed down to one direction by vendors moving their carts into the road, closing off the outer lanes. Pedestrians, automobiles, and donkey carts clog the streets. In some sectors of the city, it can take more than an hour to move one to two city blocks at midday.

Mission Planning and Execution

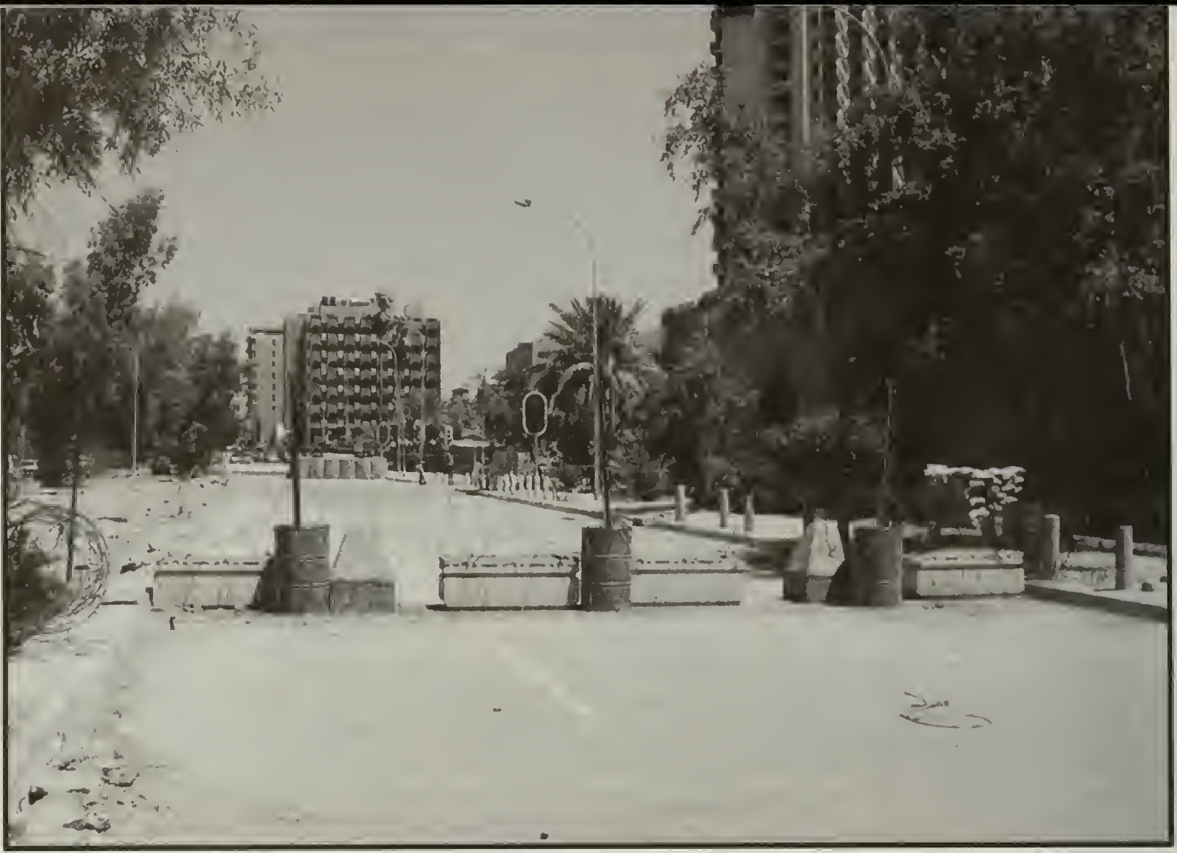
Constructing force protection in an urban environment follows the same principles learned at the U.S. Army Engineer School and the combat training centers (CTCs). It is still the engineer lieutenant on the ground coordinating linkup with the maneuver force, assessing the situation, making a plan, and executing it. Serpentines and fighting positions must still be proofed. Unlike at the Engineer School and the CTCs, your work is tested the next day. You know very soon if the barriers you constructed will prevent drive-by shootings, car bombings, sniper attacks, or angry mobs from interfering with FOB operations. Certain aspects of working in Baghdad add a new complexity to the combat engineer role. Many lessons on Class IV and barrier materials, equipment, and emplacement were learned—and learned quickly.

Construction Materials and Equipment

Initially the supply and resupply of Class IV materials was an issue. Units from the 3d Infantry Division used whatever was available for the immediate force protection requirement. This included vehicles—both military and civilian—as barriers, Iraqi "concertina/barbed wire," rubble, and earthen berms. As the battalion accepted the mission in East Baghdad, improvements were needed for a longer-term solution. Hesco® bastions (see photo on page 14) and concertina wire became the primary resources for temporary barriers and walls. Units should be prepared to hit the ground with an initial combat load of barrier materials and understand the terrain they may occupy.

Hesco fill material is another issue when working in an urban environment. Sources within the confines of a concrete landscape are limited. Contracting through local sources was crucial to mission accomplishment. Initially, combat heavy engineers and corps wheeled engineer units were not available to assist. Our battalion does have six organic small emplacement excavators (SEEs), but they could not fill the large number of Hescos required. Company FOBs needed an average of 100 Hescos for their perimeter, entrance gates, dismounted and mounted positions, and serpentines at entrances. The SEE tractor can fill a Hesco in about 10 trips as opposed to a 5 1/2-yard bucket loader that can load three large Hescos at a time in only two trips. Hescos proved to be an adequate temporary solution, but in high-traffic areas, they tend to break apart after vehicles cut corners too sharply.

The battalion formed and supervised Task Force Rascal, which consisted of 60 Iraqi civilians, one 5 1/2-yard bucket loader, and two civilian 15-cubic-meter dump trucks. The Iraqi workers would arrive on-site with loads of gravel or dirt and refill from a pre-positioned dumpsite at the 16th Engineer Battalion base camp (Camp Ultimo). On many occasions, fill material was drawn from within the FOB where we were working or from the immediate outer perimeter. This was a temporary fix, but in some instances this created a mobility concern. Digging in the city exposes water and sewer lines and creates large amounts of dust. As the availability of Hesco bastions ran short, the 3d Infantry Division's Engineer Brigade (distributor of Class IV supplies for the division) provided 55-gallon drums and other materials.



A barrier in front of the Palestine Hotel in Baghdad was constructed using 55-gallon drums with pickets and concertina wire.

We were able to find additional uses for these drums, other than as clearing barrels and fuel reservoirs. By using them as supports for 8-foot pickets, and also as a barrier filled with rock, the nonstandard wall proved efficient and readily available. This method of fencing was invaluable in concrete terrain when the only alternative was using the SEE truck's hydraulic picket pounder to drive an 8-foot picket through the highway pavement or sidewalk.

New Jersey barriers, better known as concrete highway dividers, were initially in short supply. Measuring 9 feet long by 3 1/2 feet high, they are perfect for the urban terrain and were used primarily as serpentines to FOB entrances and traffic lane dividers. The heavy expanded-mobility tactical truck (HEMTT) with a crane can transport and emplace up to ten barriers.

The SEE proved invaluable for FOB construction. The front bucket easily moves concrete flowerpots (similar to ones used at U.S. military facilities to impede traffic) to incorporate them into the defense plan. We also used flowerpots to redirect traffic and control movement on streets, sidewalks, and bridges. Fortunately, the former regime used flowerpots throughout the city for the same purpose, and they were in ample supply. We simply relocated them for our benefit.

Based on location and available resources, the use of Hescos around some perimeters was impractical. Initially, Bravo Company, 1st Battalion, 36th Infantry Regiment's FOB consisted of 300 meters of new cars that the previous unit had parked around the compound and then disabled. Seeking a better solution for force protection, the 1st Armored Division commander required the removal and upgrade of any FOB that used disabled vehicles. We hired an Iraqi contractor with a crane and flatbed trucks to remove the disabled vehicles. Due to the extensive frontage of the perimeter and the low supply of Hescos at the time, we used storm water piping (6 meters long by 1 1/2 meters in diameter) as barriers. These required a 30-ton crane, either from an Iraqi contractor or a heavy engineer company, to haul and emplace. The pipes will stop any attempt to ram or run the perimeter of the compound and are excellent protection from small arms and rocket-propelled grenade attacks.

Emplacement

The platoon and company leadership quickly learned that part of terrain analysis was thinking like an urban traffic engineer. As in other operations, assured mobility was essential. Traffic flow had to be considered not only for potential congestion but also for mission-execution planning. Closing off all civilian traffic in the vicinity of an FOB would be ideal for force protection. It would also assist in moving equipment in the area and giving soldiers the battlespace to work. However, during stability operations and support operations and trying to return a city to normal, city infrastructure and civilian traffic mobility must enter into planning considerations.

The weather is an important consideration. The temperature in June, July, and August can reach higher than 120 degrees Fahrenheit during the day. For soldiers traveling in a military vehicle with body armor and Kevlar®, the temperature far exceeds this. It is safer and equipment efficiency/productivity is much higher if the unit operates on a reverse-cycle schedule.

The Coalition Provisional Authority and U.S. forces imposed a 2300 curfew on the Iraqi people. The local population is out in the city and on the streets from 0800 until about 1600. After that, most people in Baghdad return to their homes to defend their property from looters. During the day, differentiating between the friendly and the enemy may be impossible until it is too late.

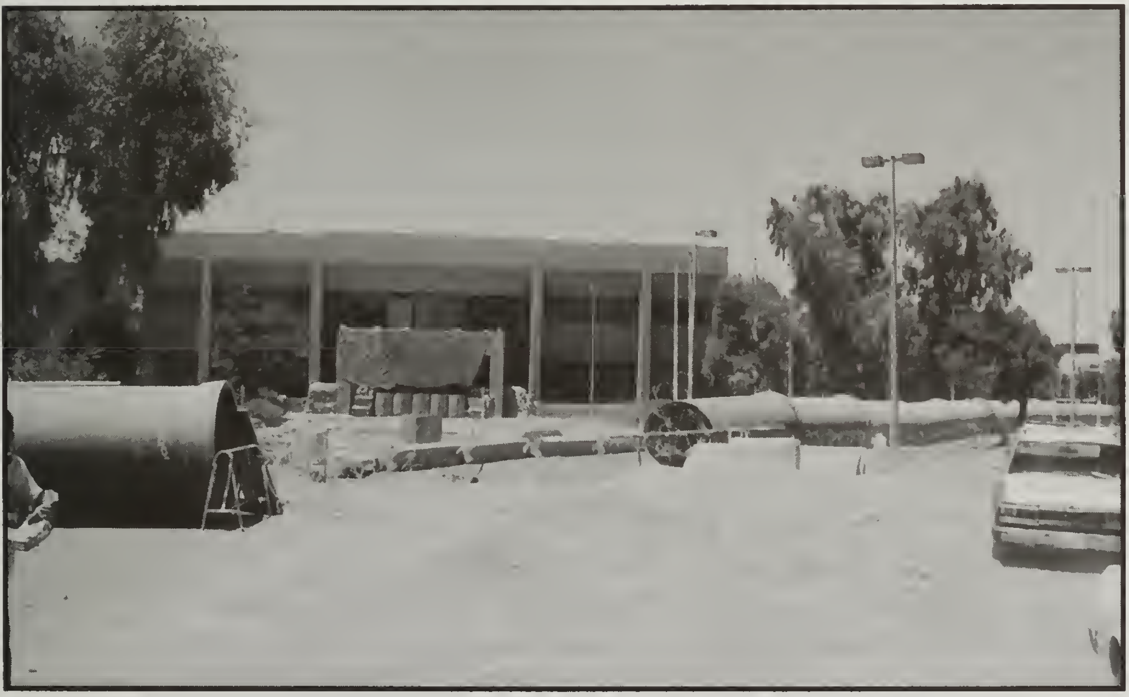
Banking District Missions

The missions we executed in the banking district help illustrate the benefits of performing missions at night in Baghdad. A platoon from 1st Battalion, 36th Infantry Regiment, had the mission to occupy and guard a series of Saddam's former banks in the oldest and most congested area of Baghdad. During the day, thousands of Iraqi people swarmed this platoon FOB, most with the intent to exchange currency, but some with the intent to do harm to each other and to the American soldiers guarding and regulating traffic in the facility. Working in this area in daylight was out of the question. We started force protection upgrades around 2100. Local gangs spent much of the night shooting at each other. Our vehicles moved to the side of the road, closer to buildings, to avoid being hit by the bullets that frequently whizzed up and down the narrow streets. Imagine working the controls of a HEMTT cargo crane, downloading New Jersey barriers, and stopping every 10 minutes to take cover. Once the shooting subsided, we returned to the mission and stopped work only when the mission was complete.

These experiences add definition to the term "combat engineer." Returning fire is difficult. Rarely do you see a muzzle flash, and the source of the rounds is usually unseen. Echoes make it extremely difficult to home in on the direction of fire. Even though the shots were close enough to "pop" the sound barrier and fill the air with the now-too-familiar cracking sound of a bullet passing close by your head, we could not return fire on a target.

On this site and others, FOB construction was driven by immediate necessity. FOB force protection became a phased operation: First, we built what we thought needed to be built. Second, we assessed what reaction the enemy had to our fortifications. Third, we developed controls based on the enemy reaction. It was an ongoing process. A day after we completed a Hesco and concertina perimeter at the banking district FOB, an enemy combatant threw a pipe bomb over the wall, hitting a tree the soldiers on guard were using for shade. The bomb exploded at eye level, killing one soldier. The next day our unit was back on-site with more wire, installing a guard tower and cutting down the tree inside the perimeter with chainsaws. We ensured that the guards were off the ground, eliminated obstructions, and increased the perimeter standoff. We hired Iraqi contractors to erect a 15-foot-high chain-link fence secured atop the Hescos, preventing further hand-thrown ordnance attacks.

Working at night also has its drawbacks. Iraqi unwillingness to work at night, rolling blackouts, and the lack of visibility are just some of the concerns. Iraqi civilians contracted to haul fill material and operate bucket loaders must be convinced to work at night. They must keep the vehicles at their homes to prevent theft. They are fearful of retribution due to contact with American forces. Many of our contracted truck operators received gunfire when leaving the work site. Iraq has rolling electrical blackouts. The grid system cannot support 100 percent power to all of Baghdad, and power production cannot meet the demand. To alleviate the strain on the utilities, officials turn power grids on and off throughout the day. Entire city blocks go dark for periods of two to four hours. Most work in the city is performed under white light. Night vision devices are used to spot snipers in windows and rooftops but overall are ineffective due to the lights of the city.



Storm water piping was used as a barrier for the perimeter of the compound.

Before 1st Battalion, 36th Infantry Regiment, could use this area inside the perimeter of its FOB for a motor pool, 26 dump truck loads of garbage had to be removed.

Nontraditional Combat Engineer Missions

Baghdad has a serious trash problem. Initially, all government agencies shut down during the major assault and occupation by U.S. forces. This included services such as trash removal. The local people turned to dumping their waste directly in front of their businesses or homes or on the highway. Many of the locations we intended to use as FOBs had to be cleared of debris first. The FOB site for Headquarters, 1st Battalion, 36th Infantry Regiment, for instance, required the removal of 26 dump truck loads of garbage. We took an Iraqi contractor to the site, estimated the amount of debris, agreed to a price and contracted for the removal, and provided security during the removal process.

We also supervised the destruction of biowaste from a hospital complex. The hospital's incinerator was non-operational, so the hospital staff deposited medical waste (to include needles, body parts, and used bandages) directly in front of the hospital. Moving the material posed a health risk, even for the contracted labor force, so we used armored combat earthmover teams to dig a large trench. All the waste was pushed in the trench, soaked in JP-8 jet fuel and motor gasoline (Mogas), and set aflame.

Another area of concern was the massive number of Iraqi military vehicles in the city and surrounding area that had been abandoned by Iraqi forces or destroyed by U.S. forces. As engineers, we accepted responsibility for hulk removal. Our battalion not only worked in the heart of the city but also in the outlying areas consisting of farmland, orchards, and irrigation canals. Again, the civilian population was used, contracting crane support and flatbed trucks to haul more than 100 vehicles out of the sector. Some of the vehicles included SA-7 rocket launchers, T-70 tanks, and bridging vehicles. Looters were quick to descend on these vehicles, mainly with the intent of taking wiring, aluminum, and other resources they could sell. We worked closely with 1st Brigade and Canadian explosive ordnance disposal (EOD) personnel to identify and supervise the removal of rockets and other explosives. We then turned the hulks over to Iraqi contractors for removal. We also worked with EOD personnel to identify caches of Iraqi Class V materials (mortars, rockets, bullets, and grenades) and assisted in their disposal.

Conclusion

Combat engineers in Iraq adapted to the conditions and met the challenges head-on. All the mission-essential task list-based training conducted before deployment could not have prepared us completely for the missions we received upon arrival. Many of them are very different from what we study at the Engineer School or during CTC rotations. To prepare, units must emphasize command and control at the platoon and squad levels, ensure redundancy of trained crews on crew-served weapons, and license all soldiers on the HMMWV.

As the Engineer School continues to train engineer leaders and develop the training plan for the Future Force, we need to add training on urban operations, stability operations, and support operations. Engineers must cross-train on TTP used by military police. New lieutenants given a fundamental background on nonlethal tactics, traffic control points, crowd control, and convoy operations would be better prepared to lead an operation that is somewhere between HIC and stability operations or support operations.

A typical mission requires the platoon leader to prepare, brief, and execute convoy operations, maintain control of crowds of curious spectators, and remain vigilant for those who wish to do harm. Much of the success on-site came from innovative and creative squad leaders and platoon leaders who used initiative to work with limited resources to accomplish the commander's end state.

Regardless of the spectrum of conflict, U.S. forces need force protection. Now our units operate from safe and secure FOBs, taking the fight to the enemy. Units are able to focus on offensive operations with their "backyards" secure.

Captain Railsback is commander of Charlie Company, 16th Engineer Battalion, Geissen, Germany.

Capturing the Lessons of War - The Engineer Perspective on Operation Iraqi Freedom

By Lieutenant Colonel Jack Drolet and Major Glen Masset

Upon completion of Phase III of Operation Iraqi Freedom, the U.S. Army Engineer School determined the need for a comprehensive review of engineer issues. The forum for this was achieved from 3–5 November 2003, when senior leaders of the Engineer Regiment met in Savannah, Georgia, in conjunction with the Savannah post of the Society of American Military Engineers and the Army Engineer Association Regional Conference. As an integral part of the conference, a Warfighter track was established to give leaders an opportunity to hear from those who participated in Operation Iraqi Freedom and to discuss emerging issues for engineer units and soldiers.

The conference began with presentations ranging from operational planning down to the tactical execution of ground combat. The intent was to have the operational perspective set the foundation for tactical-level presentations. To examine all aspects of the conflict, representatives from the sister services and coalition partners presented their views of engineer operations. The culmination of the conference was a series of breakout sessions designed to stimulate discussion and generate issues that need to be resolved for both present and future engineer operations.

Colonel Charles Smithers, assistant chief of staff, C7 (Engineer), 3d Army/Army Central Command (ARCENT)/Coalition Force Land Component Command (CFLCC), and Colonel John Lendrum, G3, 416th Engineer Command, provided the operational-level presentations and highlighted theater planning, the design of engineer force packages, and the unique aspects of command and control of Active and Reserve Component unit deployment. The joint and multinational panel consisted of Colonel Michael Boyd, U.S. Marine Corps, Colonel Neil Kanno, U.S. Air Force, Captain William McKerall, U.S. Navy, and Colonel John Shanahan, United Kingdom Royal Engineers, who discussed engineering aspects from their services' perspectives and joined in a panel discussion with members of the conference. The tactical-level perspective was provided by Colonel Gregg Martin, Commander, 130th Engineer Brigade, and Colonel John Peabody, who commanded the 3d Infantry Division's Engineer Brigade. This forum provided a close look at the tactical employment of engineers on the drive to Baghdad.

The panel discussion provided a candid view of some of the most critical engineer issues facing the Regiment today. The U.S. Army Corps of Engineers (USACE) involvement was detailed by Major General Carl Strock, Director of Civil Works, USACE. His presentation outlined the wide breadth of USACE involvement, from support to the Coalition Provisional Authority in restoring the basic infrastructure of Iraq, down to direct support of combat forces on the battlefield. Breakout sessions were designed in a round-robin fashion to ensure that all conference participants were able to discuss each of the subject areas of battle command, mobility, and construction.

In total, the Engineer School has formally captured roughly sixty engineer issues taken from Operation Iraqi Freedom lessons learned (Phases I through III). To address these issues, the school has assembled an Operation Iraqi Freedom doctrine, organization, training, materiel, leader development, personnel, and facilities (DOTMLPF) action officer board, with representation from across the Maneuver Support Center. The purpose of this board is to analyze engineer lessons learned in detail and formally document recommendations for improving the Regiment, utilizing the full DOTMLPF framework. The ultimate goal is to implement actions to resolve the majority of these issues or explain why an issue cannot or should not be solved. As this board continues its work, it will share periodic updates with the field and intends to publish a formal document before ENFORCE 2004 (26-30 April).

As Operation Iraqi Freedom and Operation Enduring Freedom missions continue into the future, we encourage units to keep sending relevant lessons learned and after-action reviews to the Engineer School Center for Engineer Lessons Learned (CELL). Submissions remain vitally important to support the Current Force and to take into consideration as we shape our Future Force. Unclassified information can be sent to the CELL by e-mail to <*reggie.snodgrass@us.army.mil*>. Classified information can be sent by secret Internet protocol, routed (SIPR) e-mail to <*massetga@monroe.army.smil.mil*>.

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Major Masset is Deputy Chief of Staff, U.S. Army Engineer School.

Innovative Engineers Pave New Paths in Afghanistan

By Major Steven A. Baker

Operation Enduring Freedom moves into its second year, and the engineers in Afghanistan have moved beyond initial-entry operations. They have started to attack some of the daunting general engineering and mobility challenges posed by this arid and austere environment. The 82d Airborne Division's 307th Engineer Battalion airfield repair team at Kandahar International Airport has introduced several construction initiatives in runway repair that will not only prolong the lifespan of the deteriorating airfield but also may change the way contingency airfields are repaired in the future.

One of the first problems that the team noticed in July 2002 was that the concrete runway repairs made by the first coalition engineers to arrive at Kandahar were causing the asphalt around those patches to crack excessively. (See *Engineer,* July 2002, page 8) The cracks were due to the cold joint between the flexible asphalt pavement and the rigid Portland cement patches. While this technique kept the runway open for the first deployments and resupply, it created unacceptable debris after the summer relief in place of major combat forces. This method of repair—aggravated by extreme temperature swings between the day and the night and extremely dry air—did not provide a suitable long-term solution.

To overcome the cracks in the asphalt around the patches, the airfield repair team initiated several successful material and procedural changes that have been approved by Air Force officials throughout the area of operations. The first significant method involved cleanly cutting and removing damaged areas, setting the concrete form inside the hole, and then filling the resultant gap between the asphalt and the Portland cement patch with cold-patch asphalt. The technique creates a flexible, easily maintained joint and a repair that can withstand thousands of sorties of traffic with only minimal additional maintenance.

The first step of the method is cutting out and excavating the damaged areas of asphalt. The key to this step is the use of a concrete saw with a diamond-tipped blade to create clean, linear cuts and a skid steer loader to quickly excavate the damaged asphalt down to the subgrade. The subgrade is then compacted and additional fill gravel is added so that the concrete patch created will

Task force engineers inspect a damaged section of asphalt.

be 8 to 10 inches thick. The form is cut and installed to create individual cells that are typically no bigger than 300 square feet. Plastic sheeting is placed over the gravel to prevent water required for hydration from percolating through the gravel. No. 5 rebar (12 inches on center with lateral bracing that is 16 inches on center) provides additional strength and minimizes cracking.

Finally, the site is ready for concrete placement with Type I cement, a change from the initial repairs that were done with Type III cement. The summer heat and lack of humidity caused the team to switch to Type I cement. It provided a mix with slower hydration but still offered the strength required for an airfield. The concrete is placed with an M919 concrete mobile and worked with standard tools and methods, including a hand-operated concrete vibrator, provided and operated by the 769th Engineer Battalion from the Louisiana Army National Guard.

To ensure that enough water is available for hydration, sandbags are placed over each new pad and watered regularly. After several days of curing, gravel is placed in the gap up to the level of the existing asphalt and then cold-patch asphalt is added and compacted to create a level surface for aircraft use. Asphalt sealant is then spread over the asphalt and the cold-patch to waterproof the joint. The result is a durable surface that can receive thousands of sorties, to include C-5 Galaxy aircraft, with little or no additional maintenance.

Offset framework, complete with vapor barrier, is ready for the arrival of the concrete truck and crew.

Kandahar is such an important logistics hub in the region that the amount of time the airfield can be closed, or its usable threshold altered, is very limited. This is especially true in the summer when hot, thin air and a 5,000-foot altitude force many aircraft to use much of the total length of the 10,475-foot runway. This, combined with the fact that much of the runway is infected with deep spider and alligator cracks, requires rapid runway repair when the pavement does fail. The solution to this challenge was achieved after operational testing. The result is a quick and effective soil patch that requires minimal maintenance, produces little debris, and can be constructed in 2 to 3 hours by a trained crew.

The early steps in this method mirror those of a preplanned concrete patch. A square or rectangular patch is cut and excavated down to the level of the subgrade. Then 2-inch slump concrete is placed in 2- to 3-inch lifts, raked of large aggregate, and covered with a thin layer of coarse sand. This process is repeated until the grade of the existing asphalt pavement is reached.

The last step of the method involves dust control. To prevent "brown-out" conditions that hamper visibility, EK 35®, a commercial dust control agent, is spread over the soil patches in several thin coats until the agent begins to pool. This nonflammable, noncorrosive binding agent not only prevents brownouts, it actually increases the durability of the soil patch. The dust control agent has been so successful that it has been used on many of the high-traffic shoulder areas of the airfield and on many of the helicopter landing zones throughout the Afghanistan area of operations.

A recently stabilized soil patch is prepared for an application of dust control agent.

An overhead view of Runway 23 shows that Federal Aviation Administration-approved reflective paint, plus a recent application of asphalt sealant, can make a runway look new despite its age.

The advantages of this unique soil patch technique are more than just speed and durability. When the patches fail, as they typically do after about 2,000 sorties, they fail in thin layers that tend to crumble into a nonthreatening sandy residue rather than into dangerous pieces of gravel that could destroy an aircraft engine. This technique does not require cumbersome airfield matting to be drilled into the existing runway surface before aircraft can land. In July and August 2002, more than a dozen C-5s landed on these soil patches without incident.

As a result of the success of these durable soil patches and the outstanding performance of the skid steer, the 307th Engineer Battalion is reviewing its current doctrine and equipment required for the rapid runway repair mission. A significant savings in the airframes required for a light airfield repair package mission could be seen if the skid steers (after heavy-drop certification) replace the current dozer—the deployable universal combat earthmover (DEUCE)—and if the extremely heavy runway repair matting was simply deleted and replaced with additional cement and finishing tools.

Another innovative construction technique used at the Kandahar airfield involved the close coordination of the airfield repair team, the airfield manager, and the U.S. Air Force. As the long-range plan for the repair of the runway was being jointly scripted, it became obvious that some of the major repairs would reduce the usable threshold of the runway by several thousand feet due to the position of the damaged sections. This was unacceptable during the heat of the summer because the heavily laden aircraft needed as much runway as possible to lift off.

Because Kandahar's main runway is 148 feet wide, the team agreed it would be feasible to offset the runway centerline to the east and then to the west to accommodate repairs on each shoulder. This would keep them from postponing much of the necessary construction into the cooler weather of the fall and winter when the threshold could be reduced without affecting air traffic. While this scheduling option required the airfield repair team to paint and repaint the runway centerlines, and required the airfield manager to issue numerous Notice to Airmen warnings, it allowed the runway construction to proceed so that much of the major construction would be complete before the onset of winter precipitation.

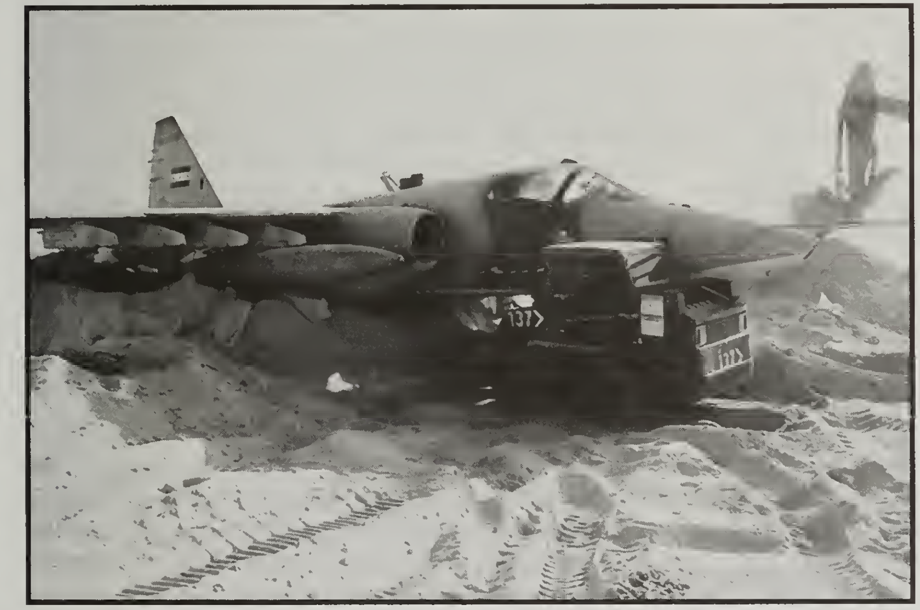
Major Baker is the executive officer of the 307th Engineer Battalion, 82d Airborne Division, at Fort Bragg, North Carolina. He recently returned from a six-month tour in Afghanistan as the Coalition Task Force C-7/Task Force Panther engineer. His previous assignments include commander of A Company, 307th Engineer Battalion, and commander of the 82d Airborne Division Advanced Airborne School. He served in the 547th Engineer Battalion in Germany and in Saudi Arabia during Operation Desert Storm and with the New York District Corps of Engineers in New Jersey, Greenland, Albania, Macedonia, and Kosovo. He is a graduate of the United States Military Academy and holds a master's in civil engineering from the University of Florida.

Uncovering Mysteries in the Iraqi Desert

By Sergeant Jodie Stansbury

There are many mysteries hidden under the sand dunes of the Iraqi desert, and soldiers of Alpha Company, 142d Engineer Battalion (Combat)(Heavy), North Dakota Army National Guard, had the opportunity to help uncover five of them.

The land surrounding Peacan Base is littered with man-made sand hills intended to conceal Iraqi fighter jets. Many soldiers have yearned for the chance to dig them out, but until now they had no authorization. A team from the Iraq Survey Group (ISG), consisting of American, British, and Australian soldiers, was sent to the abandoned Iraqi air base where the 142d Engineer Battalion is located, with authorization to unearth five of the preserved aircraft hidden there to study their capabilities.



A soldier from the 142d Engineer Battalion uses a Bobcat® to dig out the wheels of a jet.

The team called on the engineers to help excavate the jets to shorten the recovery process from possible months to just days. Without the assistance of the engineers and their equipment, the jets would have been dug out by hand, which would not have been a good mission for any soldier in the desert heat.

The project, completed in five days, was one of teamwork and patience. The joint crews excavated one jet per day, working from 0500 until noon. The work hours were crucial to the mission, not only to prevent heat casualties but also to avoid working around the aircraft when excessive heat creates volatile conditions for the jet's fuel and any ammunition that might still be stored inside.

The aircraft, once uncovered from the sand, were towed back to a hangar at the air base by a heavy equipment transport trailer, and numerous ground guides made sure the jets made it back in one piece. Once within the secured perimeter, the Russian-made fighter jets were then either stripped of necessary parts or parked to wait for transportation to the United States for further research into their power and capabilities.

The combined efforts of the coalition forces showed the soldiers the endless possibilities of working together.

Sergeant Stansbury is a member of Alpha Company, 142d Engineer Battalion (Combat) (Heavy), North Dakota Army National Guard.

Environmental Issues Associated With Operation Enduring Freedom

By Mr. Robert J. Chartier

Military action in Operation Enduring Freedom was the first measurement of the concepts of integrating environmental considerations in military operations since the June 2000 publication of Field Manual (FM) 3-100.4, *Environmental Considerations in Military Operations.* According to the manual, "National security strategy and operational end states support lasting victories. End states include environmental components."[1] In the first year of deployment to Afghanistan and Uzbekistan, U.S. forces faced numerous challenges in meeting these end states related to protecting the environment from the effects of the coalition footprint and protecting the force from existing environmental hazards. These hazards, in many cases, were the result of years of inconsistent application of environmental laws, regulations, and programs by the host nation. Without host nation laws and regulations, U.S. forces were required to default back to U.S. environmental policy requiring that all joint U.S. military operations include effective environmental integration. U.S. Army engineers on joint staffs and below are responsible for incorporating environmental considerations into military operation plans (OPLANs) and operation orders (OPORDs). However, it is the responsibility of soldiers to execute the Army's environmental mission, whether deployed or at their home station. This article discusses Operation Enduring Freedom environmental considerations as a command guidance issue.

Levels of Environmental Consideration

Even though Department of Defense Directive (DODD) 6050.7, *Environmental Effects Abroad of Major Department of Defense Actions,* specifically exempts combat operations from meeting environmental requirements, it was an assumption in the combatant commander's OPORD that press coverage and worldwide public interests could scrutinize U.S. environmental security actions. This assumption becomes reality if leaders at all levels fail to recognize the impacts of their operations on the environment. Joint Publication (JP) 4-04, *Joint Doctrine for Civil Engineering Support,* states, "Joint Forces Commands (JFCs) should demonstrate proactive environmental leadership, instill environmental ethics, and promote environmental awareness throughout the joint force."[2] Consideration for the environment is nothing more than the integration and application of environmental risk management incorporating all aspects of the natural environment as they interact with the conduct of military operations. This process can be as simple as conducting oil spill battle drills or as complex as avoiding environmentally sensitive areas. Thus, in the context of risk management, environmental considerations should receive a minimum level of thought no matter what conditions and constraints U.S. forces operate under. Environmental considerations need not become mission-constraining.

A prescribed burn at the Baghram landfill sends smoke from incomplete combustion blowing across the base camp.

The leaking containers at right should be in the plastic-lined pit at left. Unopened containers at left should be stored elsewhere.

FM 3-0, *Operations,* states, "As missions change from promoting peace to deterring war itself, the combination of and transition between these operations require skillful assessment, planning, preparation, and execution."[3] This holds just as true when considering the environment depicted in Figure 1, page 25. It shows how the level of environmental considerations changes as the intensity of operations transitions from peacetime operations through the employment of forces and back to peacetime operations. As operations transition from peacetime to wartime, the opportunity to fully incorporate environmental considerations decreases. However, once in theater, there are still opportunities to incorporate environmental considerations into daily activities whether forces are employed in high-intensity conflict (HIC) operations such as direct combat or low-intensity conflict (LIC) operations such as peace enforcement. The shaded area of Figure 1 depicts an area between pure LIC and HIC operations where the level of environmental consideration may fluctuate within any given time.

The base camp is the most logical setting for this transition to occur, because hostilities have likely decreased and force protection levels and work priorities allow increased efforts in other areas, such as the environment. The relationship between Karshi Khanabad—the base camp in Uzbekistan—and those in Afghanistan exemplifies this point. Karshi Khanabad supported operations in Afghanistan and was not involved in direct combat operations. Thus environmental considerations were integrated into daily activities from the base camp design stage to present-day operations.

In Afghanistan, the base camps at Khandahar and Baghram progressed more slowly, because the primary concern was force protection. As force protection infrastructure improved, such as the establishment of a fixed perimeter, more effort was focused on environmental issues. These issues included waste stream and wash rack operations, construction of landfills, and construction of hazardous waste and used oil collection points. A disparity also existed between the base camps within Afghanistan: Baghram was a more primitive camp than Khandahar, so environmental initiatives had yet to be elevated in the priority of work. However, environmental conditions that presented an acute health hazard received the highest priority at all base camps and were quickly resolved. This included construction of consolidated landfills and information messages to help soldiers avoid potential chemically contaminated sites.

There were no controls over material placed in this Baghram landfill.

Environmental Guidance

Environmental guidance was provided from three command levels, each with varying degrees of success. The combatant commander of U.S. Army Central Command (ARCENT) issued Environmental Annex L, *Environmental Considerations,* to the OPORD and directed that environmental baseline surveys be conducted at the proposed base camps. The coalition joint task force (CJTF) commander issued an OPORD (mirroring the combatant commander's OPORD), a trifold environmental user's guide, a task force Contingency Environmental Guide, and an environmental policy memorandum. The local base operations (BASOPS) commanders also issued two policies governing actions on the base camps.

ARCENT Guidance

Annex L, produced three months after the initial deployment of forces, was written by the Joint Forces Command engineer staff. This annex provided the groundwork for resolving situations where real or perceived conflict existed between environmental protection and mission accomplishment. The annex directed that preservation of the natural environment

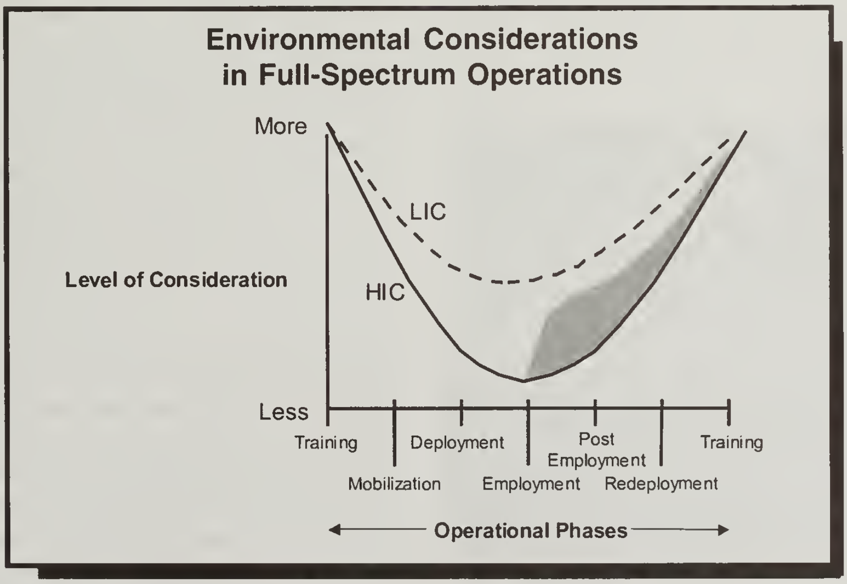


Figure 1. Levels of Environmental Consideration

A lack of secondary containment structures at this pump location allows leaking fuel to contaminate the ground and possibly the groundwater.

should not be ignored in the execution of orders but that environmental considerations would always be subordinate to the preservation of human life and force protection. These statements, and the publishing of the annex three months into the initial deployment, made environmental considerations a nonissue for the initial deployment forces. This presented a challenge for leaders during relief-in-place operations because follow-on forces continued to operate in the same manner as the initial force even though Annex L existed. This was a result of the nature of the relief-in-place operations and the use of fragmentary orders (FRAGOs) that never required the review of the annex.

Annex L contained very descriptive information and requirements that would have helped follow-on forces if the information had been disseminated effectively. The annex was composed chiefly from the requirements in Army Regulation (AR) 200-1, *Environmental Protection and Enhancement*, which provided extensive guidance through all phases of the operation, from predeployment to redeployment. This included requirements for assigning unit-level environmental coordinators; conducting predeployment training; obtaining required manuals; and shipping adequate storage containers and spill containment and cleanup materials. Commanders were also required to provide familiarization training covering the contents of Annex L, unit-level plans, and standard operating procedures. This information could have prevented the waste stream problems that occurred later in the deployment, including two lithium battery fires due to improper storage procedures. Had they referred to FM 3-100.4, each member of the staff would have had clear guidance on conducting their respective missions in coordination with the commander's intent.

Improper disposal of lithium batteries presents a fire hazard.

As the first in-theater measure, the combatant commander requested that the Corps of Engineers and the Center for Health Protection and Preventive Medicine (CHPPM) conduct separate surveys. The surveys detailed existing environmental conditions at sites selected for base camps and were conducted within the first four months of Operation Enduring Freedom. Engineers conducted an environmental baseline survey (EBS) to document existing environmental conditions for use in base camp planning. When U.S. forces depart, the survey will also be used as a basis for comparison against a site closure report that documents the end state condition of the sites. U.S. forces effectively become the caretakers of the sites and under international law are subject to litigation for any environmental damage not justified under the laws of war. Both the EBS and site closure reports are critical documents that record activities of U.S. forces and are maintained with the resident facility engineer team, which doctrinally assumes the role of the deployed public works directorate. Examples of an EBS and a site closure report are available in FM 3-100.4.

CHPPM surveyed environmental conditions to determine the potential for both short- and long-term health implications on the force. This information was used to conduct a force health protection risk analysis for each site with risk mitigation procedures published as a FRAGO almost five months after the last survey. The FRAGO reached the maneuver forces much quicker and was more effective in providing environmental information than either Annex L or the policy memorandums from the maneuver or BASOPS commanders.

CJTF Guidance

The next in-theater measure was the publication of CJTF guidance documents aimed at maintaining a high level of environmental quality during contingency operations. The CJTF developed its guidance about ten months into Operation Enduring Freedom, using Annex L, the EBS, and the CHPPM survey. In addition, U.S. Air Force doctrine and reachback to the Air Force Center for Environmental Excellence were used, because the resident expert in the CJTF engineer staff was an Air Force officer who was most familiar with Air Force procedures. As U.S. doctrine shifts to the Future Force, more headquarters staffs will become joint services. Therefore, commanders must be prepared to use all available assets and work potential intraservice doctrinal differences to provide the most adequate information to the force.

BASOPS Guidance

The final level of in-theater environmental guidance, developed by the facility engineer team assigned to the BASOPS, was directed at forces conducting life-support activities on base camps. The environmental engineer assigned to the team was tasked with developing and implementing this guidance while working within force protection priorities assigned by the CJTF and task force commanders. This was often difficult, because no resident environmental representative was on the task force engineer staff to champion environmental initiatives. This resulted in a disruption of environmental information reaching maneuver units and prevented environmental concerns from being addressed to soldiers at the lowest level. In Khandahar and Baghram, the BASOPS commander addressed these issues during the daily battle update briefing, once they were elevated to his level. Future plans called for incorporating this information into the in-process briefing for soldiers and for conducting unit environmental assessments. Karshi Khanabad provided this information to soldiers in the in-process briefing and through command information programs such as information boards (Figure 2) and policy letters. Facility engineer teams that deployed with an environmental engineer were better prepared and more aggressive in developing and providing this information to soldiers. The environmental engineer, often without support, conducted small cleanup operations and trained soldiers one-on-one as the situation arose. This individual should be regarded as a valuable asset when assessing mission-manning requirements.

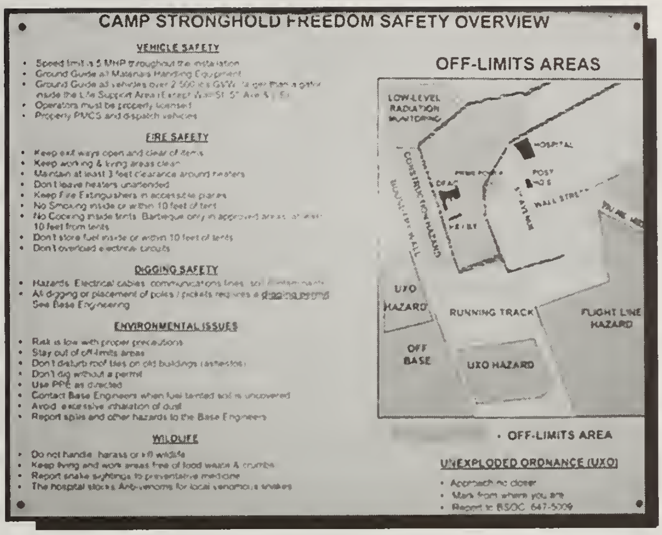


Figure 2. An information board at a base camp provides environmental and safety information to newcomers.

Conclusion

The U.S. Army Engineer School is the Army proponent for integrating environmental considerations into doctrine, organization, training, materiel, leadership, personnel, and facilities (DOTMLPF) and military operations. As the proponent, engineer leaders at all staff levels must be prepared to champion mission-focused environmental considerations as outlined in FM 3-100.4. Higher-level guidance documents such as an overseas environmental baseline guidance document or a foreign governing standard are not detailed enough to provide useful information to maneuver forces. Thus engineers at a minimum must ensure that an environmental annex is developed and disseminated to the force in the earliest stages of the operation. They must also ensure that an environmental criterion receives the appropriate visibility in the commander's critical information requirement. This information is necessary for leaders and soldiers because they are likely to endanger themselves and the environment unnecessarily. Ultimately, U.S. forces are bound by an environmental ethic equal to that found in the United States and should be provided the direction to act accordingly.

Endnotes

[1] FM 3-100.4 *Environmental Considerations in Military Operations*, 15 June 2000, p. 1-1.

[2] JP 4-04, *Joint Doctrine for Civil Engineering Support*, 27 September 2001, p. xii.

[3] FM 3-0, *Operations*, 14 June 2001, p. 1-16, 17, para 1-49.

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AR 200-1, *Environmental Protection and Enhancement*, 21 February 1997.

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Mr. Chartier is an environmental training specialist at the U.S. Army Engineer School's Directorate of Environmental Integration, Fort Leonard Wood, Missouri.

Increasing Safety in Afghanistan

Clearing Large Areas in a Fast and Reliable Way: A New Engineer Task

By Lieutenant Colonel Thomas Sponfeldner

In August 2002, German engineers expanded their equipment inventory with another special vehicle. A representative of the German army chief of engineers took over the Minebreaker, a mine-clearing vehicle manufactured by Flensburger Fahrzeugbau Gesellschaft (FFG). Now, German engineers can clear large areas of mines quickly and reliably.

Area clearance became an issue for the first time during the International Force peacekeeping mission in Kosovo and Stabilization Force mission in Bosnia, and later during the Kosovo Force peacekeeping mission. The requirement was to quickly proof and clear large areas that were possibly contaminated by mines and unexploded ordnance (UXO). Only then would it be possible to increase the safety of friendly forces in the vicinity of airfields, warehouses, and logistic transshipment sites and along roads. Previously, the Keiler armored mine-clearing vehicle had been used for that purpose, but the Keiler is a tactical vehicle for making fast breaches through minefields under combat conditions. The vehicle provides a safety lane 4.7 meters wide, milling the ground in the lane down to a depth of 25 centimeters. The soil, including any ordnance, is thrust to the side. Ordnance that is not activated remains in an inert state.

With the Afghanistan mission, the International Security Assistance Force (ISAF) requirement of large area military clearing was quickly brought back into focus. The first contingency forces used the Danish ISAF explosive ordnance-clearing platoon, which was equipped with a Hydrema mine-clearing vehicle. However, when the Danish platoon withdrew, this capability was no longer available.

In cooperation with the German Office of Defense Technology and Procurement, a market screening was performed. Among the systems that were tested and rated operational, the FFG Minebreaker was the only system that was readily available. A final test with live antitank mines at the technical center of the German forces confirmed that the system could clear up to 7.5 kilograms of TNT without serious damage to the clearing device. In preparation for their mission, operators and maintenance staff were familiarized with the Minebreaker during company-sponsored training.

The chief of the Mine/Countermine Division at the German army engineer school, second from left, accepts the first Minebreaker manufactured by FFG.

Next came the leap in the dark. Information about the conditions at Kabul had been collected, preliminary doctrine for Minebreaker operations had been written, and logistic support had been organized. Yet, we had to take a step into the unknown with new equipment and a new mission. This was quickly clear to the advance team when they arrived in Kabul on 4 September. There was a lot of work to do before it was possible to use the "Ferrari," as the red Minebreaker was nicknamed.

Because they had such short notice, the Turkish managers denied access to the predetermined clearing area at Kabul International Airport. Other potential areas were out of the question because they were too small or because their location made it impossible for the Minebreaker to get there. As the United Nations Mine Action Center for Afghanistan (MACA) had also charged nongovernmental organizations with mine-clearing tasks at the airport, activities had to be precisely coordinated to avoid getting in each other's way. In order to get used to the soil on-site, the Minebreaker team got the opportunity to clear the mine belt between the double fence rows around the airport. It was a worthwhile task, since antipersonnel mines were surface-laid every 2 to 3 square meters.

The arrival of the Minebreaker on 6 September was a welcome event. Within two days, the other members of the crew arrived, and the first clearing actions were started. We did not anticipate the tremendous amount of dust caused by clearing operations in this area. From trials in Germany, we were used to small dust clouds when working on sandy soil, but nothing compared to what occurred on-site. The driver sometimes could not see at all. It was fortunate that an ordnance-clearing specialist had a Fox armored personnel carrier because this vehicle could direct the Minebreaker driver. There was much room for improvement in the first few clearing lanes, but the driver's feel for the Minebreaker and for the soil improved by the meter. Maintenance started after the operation. Removing the dust was the first order of business.

The Minebreaker arrives at Kabul International Airport on 6 September 2002.

On 14 September, the first real mission was to be carried out. All preparations had been completed, and the inner fence of the mine belt was opened. At 1100, we were able to tackle the final section of the access road. At 1125, there was the first detonation, followed by four more in the next five minutes. Then we had to postpone our work because Turkish medical support units took their lunch break. When we returned from our break, there were Afghan soldiers waiting with their rifles in firing position. There was no misunderstanding this gesture—the clearing work would not continue on this site. Despite extensive negotiations, it was not possible to reach an agreement, so we ceased working.

At a meeting the next day, Afghan representatives explained that the outer mine belt was required for airport security, and this was not the only critical section on the airfield. It was not apparent where clearing would be permitted. MACA objections that the Afghan government had agreed to permit the clearing of all mines were not accepted.

In cooperation with MACA, we found new sites appropriate for Minebreaker operations, and on 19 September, the formal introduction of the Minebreaker was held. A remarkable part of the mine-clearing project was the cooperation between the German and Afghan forces, who provided the transport vehicle for the Minebreaker. So far, more than 15,000 square meters have been cleared and more antipersonnel mines and some UXO have been destroyed. The proofing of the cleared areas is partly done by explosive ordnance-clearing specialists who employ visual means immediately after the Minebreaker operation and partly by nongovernmental organization workers with metal detectors. During the proofing, explosive ordnance-clearing specialists found only one live bomb fuze. It was a solid metal body that could not be broken by the Minebreaker, so Turkish explosive ordnance-clearing specialists disposed of it.

Despite adverse climatic and geologic conditions, the results of the clearing operations can be rated very highly. Currently, clearing operations out of Kabul International Airport are carried out in the Kabul area as well as along the road to Baghram. Another operational area covering 640,000 square meters is in the vicinity of Baghram, where we operate with U.S. Army units. If the Minebreaker is used there, it will take more than six months to clear the area.

Lieutenant Colonel Sponfeldner is the section chief for mobility and mine clearance in the Department for Combat Development of the German army Pionierschule at Munich. At the time this article was written, he was in charge of introducing the Minebreaker to the German ISAF contingent in Afghanistan. He has served as a platoon leader, battalion intelligence officer, and company commander of Pionier Bataillon 4 and as company commander of Armored Engineer Company 140.

(A version of this article was published in *Pionier News,* the German Corps of Engineers magazine, Edition No. 5, December 2002.)

ENGINEER ASSESSMENT TEAMS IN DISASTER RELIEF OPERATIONS

By Captain Thomas M. Turner

Engineer support to civilian authorities during disaster relief operations is one of the primary missions of U.S. Army National Guard engineers. In today's security-centered operations, it has become more apparent that efforts to "restore or recreate essential infrastructure" must be properly coordinated, supervised, and maintained by qualified officers and noncommissioned officers (NCOs) to properly represent the capabilities and professionalism of state military department assets.[1] As a leader assigned to an engineer assessment team (EAT), you will make initial assessments of disaster severity and help organize engineer work teams (EWTs) to execute assigned missions. EATs must make the immediate decisions on the ground that meet the intent and guidance of their command or state task force.

Depending on the requirements of EATs, they must coordinate, assess the situation, develop estimates, and report findings to higher headquarters. The initial assessments can be narrow or broad in scope, but estimates will give the requirements for assistance to local authorities. Whether used for civilian rescue in flood operations or debris cleanup after a tornado or hurricane, EATs must be readily available and on the ground as soon as possible to immediately address the needs of local agencies.[2]

Civil Coordination

Civil coordination is an essential task for EATs as they enter disaster areas. In most situations, EATs will already have a point of contact for the area who will give initial civil assessments, emphasizing areas where damage is heavy or is in especially critical locations. This person will continue to be the team's primary contact unless the team is handed off to another civil authority. You could coordinate with local officials such as the mayor, county commissioners, or elected officials; local authorities such as the sheriff or city police; or local public works authorities such as the county department of public works (DPW). Each of these resources has different assets to assist you and can outsource other assets as needed. It will be important to tour the area with the point of contact and make notes on a map. Most National Guard units maintain local maps for such occasions. Designate areas of operation for both military and civilian workers so as not to crowd work areas or impede traffic. Identify local medical facilities, billeting locations, and possible contract meal sites as well. This information will come in handy when your logistics team comes in to help manage soldier care.

Note: Be sure to properly brief your officer in charge (OIC) and NCO in charge (NCOIC) on their roles, duties, and chain of command before their arrival. They will have to brief their soldiers and prepare them for what they will be required to do and what they may be up against. For example, upon arrival at a tornado damage site, our initial duty was to assist police dogs in the recovery of civilians killed in the disaster. We also helped American Red Cross volunteers comfort home owners and family members.

Civilian Resources

Use of local resources such as roads and dump sites is normally coordinated with the point of contact. The roads must be passable and designated for dump routes. It is usually a good idea to set warning cones along the roadside where vehicles will be turning into the site. Warnings for civilian vehicles will slow traffic around the sites and give team vehicles unrestricted access. It will also slow team vehicles and designate the turns for transitioning soldiers. The site itself should be easily accessible and allow multiple vehicles to maneuver. Limited space for turning around can cause delays and unwanted traffic around the sites. Identify one dump site for construction materials and another for vegetation, because it is usually not desirable to dump both types of debris in the same location. Discuss this with the point of contact, and discuss the use of a spreader at each site. It will be important to your assessment if you are responsible for spreading or piling the material at the dump site. The U.S. Army Corps of Engineers (USACE) Disaster Guidebook contains checklists that can help with local dump site selection and operation.[3] However, keep in mind that state support planning is different from federal support planning, so you probably will not have the resources that are usually available to USACE or the Federal Emergency Management Agency.

During an assessment, city, county, private, or corporate assets may be designated to assist with the cleanup. It is your responsibility to coordinate these assets and include them in the assessment. The debris area will be located along city, county, or private land. Each entity will have assets operating along with the local authorities. Also, civilian aid agencies such as the American Red Cross may be established in the area to provide disaster assistance and comfort to victims. The local DPW or private/corporate groups will manage most of the equipment you will be interested in. Assets include civilian hydraulic excavators (HYEXs), cherry pickers, loaders, fork trucks, and trash trucks. Some county trash trucks are self-loading with clamshells, which will most likely be used for trash that civilians will gather in front of their homes or along trash pickup locations.

Military Resources

Initial military support, other than organic assets, will come from resources within the state military department. They will assist in the procurement and use of fuel, parts, supplies, and services. The state military department will usually put out a memorandum to units participating in state active duty, providing communication guidance to request assistance with purchase orders for just about anything needed for official business.

Soldier Services

Other resources will help with soldier care. You must plan for billeting, meals, medical treatment, and pay during the operation. Billeting can be established by convenience or through a contractor or charity. Convenience billeting alludes to a local military facility such as an armory. The logistics team will coordinate with a local hotel or motel to establish contract billeting if it is available. However, contract billeting will probably not be available due to the influx of emergency services in the area. Therefore, if convenience and contract billeting is not available, using local charities is

A civilian HYEX loads debris after an April 1999 tornado at Benton, Louisiana.

Hurricane Lili caused widespread damage to civilian housing in October 2002.

desirable. Local church, city, or county facilities can house soldiers in a comfortable environment. Some church facilities may also have recreation equipment/facilities and meals available for emergency service and disaster relief providers, which helps with morale and welfare. Rations can initially be coordinated through your point of contact at an established emergency services meal site, but it is better to identify a sole contractor to provide continued rations in case the emergency services move or discontinue operations.

Medical facilities must be coordinated between the state's National Guard health services department and the state military department. Though the soldiers will be on state active duty and under the state military department, the health services department probably has a designated facility in the area that it normally coordinates with. Check with them first to ensure that the facility you use for medical care has dealt with military services and accepts Workman's Compensation Insurance and the TRICARE Health Care Program. Also, contact your risk management office and get the medical point of contact so you can provide billing information to the facility.

Payroll should be coordinated weekly, ending on each Wednesday or Friday. Usually, your full-time manning adjutant or personnel services NCO will cut state active duty orders a week at a time and submit them to the state military department payroll section. These orders must be certified, faxed, or e-mailed and the originals mailed to the payroll coordinator. Your payroll section will print checks and mail them to your location in about three to four working days. Managing the payroll weekly will alleviate soldier hardship and keep better accountability of soldiers.

Contracting

Contracting services is extremely important to continued operations. Material and equipment identified or stationed as part of a rapid-deployment package must be maintained to ensure operational capabilities. The logistical support team will contract items already discussed, such as billeting and rations, but it will also manage operational support items such as maintenance and special services.

Maintenance parts fall under state contracting but will be handled through normal channels. The main difference is that parts such as tires, belts, and hoses will be contracted through a local vendor that maintains the size and durability required for the equipment. Hardware items such as chainsaws must either be contracted for initial or continued use during operations or just contracted for service and repair if they are organic to the unit. A local chainsaw center or hardware store can provide the services if they accept state purchase orders.

Special services and equipment usually include nonorganic items to assist soldiers. For example, in recent operations, soldiers used face masks during tornado damage cleanup. Debris, spoiled food, and spilled chemicals caused two cases of respiratory infection, which caused unwanted downtime and follow-up care. Soldiers may also need items such as ice, gloves, safety equipment, and laundry services to maintain safety, morale, and good hygiene.

Engineer Disaster Assessment

Problems with coordination and reporting to higher headquarters prompted the development of the Engineer Disaster Assessment (EDA). The EDA gives EATs a reference to assist in the development of EWTs, support personnel, and special equipment. The EDA is simple and is broken into four sections: site makeup, load/haul equipment, personnel, and specialty items.

Site Makeup

During the tour with the point of contact, identify the number of disaster areas and plot them on your map. Find out which areas you will be responsible for and areas where the disaster path crosses city property. Once you have determined the number of sites, you must name and rate their priority based on the assessment of the point of contact. If five sites are identified, simply name them Alpha to Echo and rate them 1 to 5. Some areas may contain heavier damage or may pose a future risk to civilians. Let the point of contact make this determination, then you can report the information to higher headquarters.

A front-end loader clears away debris from road.

Sites may be divided into multiple areas based on their location and density. Grouping smaller sites will assist in the management and placement of EWTs in built-up areas. EWTs can usually manage about three to five blocks of a housing subdivision in one day. If the damage area is greater than the ability of the EWT to complete in one workday, then the site must be divided and an additional EWT must be requested. This is important for a number of reasons: First, the civilians will continue to pile debris near the street for the EWTs to pick up. Second, seeing and coordinating with a particular EWT will help the civilians properly manage debris flow and help control frustrations. Third, it will assist the OIC/NCOIC with command and control, logistical flow, and maintenance.

Site makeup also includes dump sites, entrance and exit points, and routes. These items must be identified by the point of contact and plotted on a map for reference and distribution. The construction material and vegetation dump sites will probably require a dozer on-site to pile debris and maintain dump points. Make sure to include this in your EDA, and plan for the possibility of moving these pieces of equipment if needed.

You will also need to establish an equipment park and maintenance area. Depending on your location, the point of contact may advise the use of a county motor pool, but it is more desirable to locate equipment near your billeting site or near the debris areas. Local schools offer the best locations for mass equipment storage and maintenance. You will find that emergency services will use these areas as well, so be sure to coordinate with your point of contact. Ask about environmental concerns and access to the area during off-peak operations, which may restrict use of the area.

Soldiers load debris after an April 2000 tornado at Minden, Louisiana.

Load/Haul Equipment

Load/haul refers to the use of loading and hauling equipment. Both depend on the unit table of organization and equipment (TOE) and the availability of civilian assets. However, this must not be the determining factor in the EDA. When reporting, ask for exactly the number of load/haul assets needed based on your assessment. (See figure on page 34.) In some cases, you may need to use your best judgment based on the number of assets available at the time. Unit personnel can then get additional pieces of equipment from outside the unit, such as a state

Estimating Load/Haul Assets Needed

Example 1 - Debris is spread across three blocks in a civilian housing subdivision and the dump site is 5 miles away. One EWT is needed, with one 2 1/2-yard load asset. How many 5-ton haul assets are needed?

1. Enter the average mileage to the dump site(s): 5
2. Enter the load factor (Lf) for the single load asset available: one 2 1/2-yard loader with clamshell scoop

   (2 1/2-yard loader Lf=1, HYEX Lf=1.3)
3. Enter the haul factor (Hf) for the type of haul asset needed: 5-ton dump trucks

   (5-ton Hf=1.25, 20-ton Hf=1)

   Complete the formula:

$$\frac{\text{Mileage}}{5} \times 2 \times Lf \times Hf = \_\_\_\_\_ \qquad \frac{5}{5} \times 2 \times 1 \times 1.25 = \underline{2.5 \text{ or } 3}$$

Example 2 - The debris is spread across five blocks of a mobile home park and the dump site is 13 miles away. Based on the density of damage and the work area, you determine that two EWTs are needed. There is one civilian HYEX and a private logging truck with a cherry picker on the back available to you. There are no city or county haul assets on the site. How many 5-ton or 20-ton haul assets are needed? Keep in mind your TOE (combat heavy) only authorizes the unit nine 20-ton dump trucks. The rest are 5-tons assigned to the line companies.

1. Enter the average mileage to the dump site(s): 13
2. Enter the load factor for the single load asset available: one civilian HYEX and one civilian cherry picker

   (2 1/2-yard loader Lf=1, HYEX/cherry picker Lf=1.3)
3. Enter the haul factor for the type of haul asset needed: 20-ton dump trucks and 5-ton dump trucks

   (5-ton Hf=1.25, 20-ton Hf=1)

   Complete the formula for each asset:

   HYEX with 20-ton dump trucks

$$\frac{\text{Mileage}}{5} \times 2 \times Lf \times Hf = \_\_\_\_\_ \qquad \frac{13}{5} \times 2 \times 1.3 \times 1 = \underline{6.76 \text{ or } 7}$$

Note: Know your assets, and never assume that all of them are or will remain mission capable (MC). Assume that five are not mission capable (NMC), and replace the 20-ton dump trucks with 5-ton dump trucks using a factor of 1.25. Example: Only four are MC and seven are needed. You can simply take the remainder and multiply it by the applicable Hf; 3 x 1.25 = 3.75 or 4. You will require four 20-ton dump trucks and four 5-ton dump trucks for a dump site 13 miles away.

Civilian cherry picker with 5-ton dump trucks

$$\frac{\text{Mileage}}{5} \times 2 \times Lf \times Hf = \_\_\_\_\_ \qquad \frac{13}{5} \times 2 \times 1.3 \times 1.25 = \underline{8.45 \text{ or } 9}$$

All assets must be tracked to account for the number of loads hauled and to estimate the amount of debris removed. Units can use a notepad, spreadsheet, or load ticket for load accounting. USACE has load accounting data elements as well as an example of a load ticket in its *Disaster Guidebook*.[4] Load tracking will help OICs and NCOICs ensure consistent work effort and enable them to establish process improvements during the operation.

mobilization and training equipment site or another unit, if it is needed. Also, load assets should be matched to the appropriate haul assets. If 5-ton dump trucks are requested, then ask for 2 1/2-yard loaders for them. Never ask for 5-yard loaders unless you intend to move dirt. The 5-yard loader does not have a clamshell scoop, which greatly enhances lift ability when dealing with debris. Match 20-ton dump trucks with military HYEXs or civilian assets such as cherry pickers. These larger load assets have higher lifting ability to get into the 20-ton dump bed. Without a ramp, 2 1/2-yard loaders do not have the necessary reach.

Haul assets can be a mixture of military and civilian equipment. To limit liability, it is best if military personnel load military equipment and civilians load civilian equipment, but do not assume that this will be the case. Haul capacity will vary based on the type of debris and the experience and training of the loader. The key is to ensure that no debris hangs out of the dump bed, where it could damage property or injure someone nearby.

Personnel

Soldiers selected for duty must have certain qualifications. Foremost, they must be qualified on the equipment being used. It is always a good idea to include disaster relief equipment as part of the unitwide driver's training program so that everyone is qualified on at least a high-mobility, multipurpose wheeled vehicle (HMMWV), 2 1/2-ton cargo truck, and 5-ton dump truck. Military occupational specialty (MOS)-specific operators, such as heavy construction equipment and general construction equipment operators, should be identified to operate equipment such as HYEXs, loaders, 20-ton dump trucks, and small emplacement excavators.

Soldiers must be available for duty for a minimum of one week, usually Saturday through Friday. They must bring all items needed to sustain them during the week, such as a sleeping bag, uniforms, and civilian clothes. In addition, soldiers should bring personal entertainment items to keep them occupied after duty hours.

Estimates of the number of personnel needed are based on your equipment and guidance from higher headquarters. Initially, calculate the number of drivers and assistant drivers needed by multiplying the number of haul assets by two. Then estimate two operators per load asset. One soldier will operate the equipment while the other serves as a spotter. Factor in soldiers needed to operate specialty equipment such as chainsaws and add an OIC, an NCOIC, a driver, and a two-person logistical team to transport meals and other items. Add all these together, include MOS-specific information, and contact higher headquarters for maintenance support. Usually, the maintenance warrant officer or motor sergeant will tell you what they will do to support the operation. Do not include the logistical support team or any other group outside of the EWT control. Lastly, do not forget to assign a medic or qualified combat lifesaver to each EWT, and ensure that they inventory their aid bags before operations.

Soldiers use a cherry picker to load a dump truck.

Specialty Items

Specialty items include generators, chainsaws, pioneer trailers, tools, or any other specialty sets, kits, and outfits. They also include all the things needed to maintain and service the items mentioned. In areas where most debris is vegetation, chainsaws are the best asset. If chainsaws are included in your TOE, bring all of them and have those that are NMC serviced on the state contract. An added necessity for each haul asset is a set of branch shears to cut any loose vegetation hanging outside of the dump bed. The logistical team assigned to each site should maintain gas, water, two-cycle oil, bar oil, and any other needed petroleum, oil, and lubricants. Everything else will be coordinated through your logistical support team and either brought from the unit or purchased for your use.

Conclusion

Unlike engineer construction projects, there is little reporting, no completion certificate to get signed, and no clearly defined completion date. You will find that civilians will continue to place debris by the roadside long after the military operation is completed. The duty of the EATs and EWTs is to provide relief to local authorities and civilian workers until they can handle the problem on their own, using the equipment they have. Coordinate often with points of contact and higher headquarters to keep soldiers informed of current operations, and take the time to properly plan the EWT effort so they can successfully assist in disaster relief.

Endnotes

[1] Field Manual (FM) 3-0, *Operations*, Washington, D.C., 14 June 2001, page 10-5.

[2] CALL Newsletter 93-6, Operations Other Than War, Volume II - Disaster Assistance, Fort Leavenworth, Kansas, October 1993, Chapter 9.

[3] U.S. Army Corps of Engineers *Disaster Guidebook*, Galveston District, Galveston, Texas, 1 April 1999. Appendix D. <*http://www.swg.usace.army.mil/em/mg/mguide.asp*>.

[4] Ibid., Appendix H.

References

Louisiana National Guard *Emergency Procedures Operations Plan for Natural Disasters*, Jackson Barracks, New Orleans, Louisiana, 10 March 1993.

Army Regulation 500-60, *Disaster Relief*, 1 August 1981.

FM 5-34, *Engineer Field Data*, Washington, D.C., 30 August 1999.

Captain Turner has served in the Louisiana Army National Guard for more than 16 years. He currently is in the Active Guard/Reserve as the plans officer and administrative officer of the 528th Engineer Battalion (Combat)(Heavy) in Monroe, Louisiana. He has participated in three tornado damage relief operations and one ice storm.

Disaster Relief After Hurricane Lili

By Captain Thomas M. Turner

In October 2002, Hurricane Lili made its way through Louisiana, prompting National Guard involvement in disaster preparation and relief. The 225th Engineer Group, which includes four combat heavy engineer battalions— the 205th, 527th, 528th, and 769th—and the state's other major commands supported the operation. The operation was divided into five phases: Phase I, alert and preparation at home station; Phase II, movement to forward staging areas; Phase III, employment into the area of operations; Phase IV, deploy back to home station; and Phase V, recovery and deactivation. Our battalion, the 528th, was assigned to an area in Opelousas, in south-central Louisiana.

The 225th Engineer Group task-organized each engineer battalion into two to three EATs and five EWTs, centrally controlled by the group but supported by their parent units. Later, the EATs were recalled, and the EWTs fell under the control of the established state task force. The EATs were made up of two soldiers—one officer and one NCO. Each EWT totaled 23 soldiers (including a medic) and had the following equipment: two HMMWVs, a HMMWV maintenance truck, five 5-ton dump trucks, two 2 1/2-yard loaders, an M920 with trailer, and a small emplacement excavator (SEE). EWTs were task-organized by the state task force, and the teams were broken up and deployed to separate sites to accommodate multiple needs. This method worked well for the larger sites but created difficulties for smaller teams that did not have the proper equipment for some tasks. In the case of the smaller teams, the SEE trucks were not utilized to their full potential because of their limited load capacity and lift height. The larger teams usually arrived on-site with two 2 1/2-yard loaders and four 5-ton dump trucks, which were very effective for debris removal. As this experience showed, it is always a good idea to train teams to handle different types of tasks and keep them together throughout operations. If you must develop a table of distribution and allowances (TDA) for EWTs, then create more than one TDA to handle large and small tasks using compatible loading and hauling assets.

Our EWT was lucky in that it replaced a unit that was moving to another site. All of the necessary contracts had already been established and functioned well with only minor coordination needed. Billeting was organized at the National Guard Armory in Opelousas, which was well suited to handle the number of soldiers and the EWT's administrative needs.

Chainsaws became a problem due to serviceability and the number requested (24) versus the 19 organic to our unit.[1] Usually, we set up a contract with a local hardware store or chainsaw retailer to provide service and support at larger disaster relief sites. However, smaller sites did not have this support and EWTs quickly ran into problems obtaining chains and bar oil. Most of the 5-ton dump trucks were drawn from mobilization and training equipment sites, which assisted in equipment recovery and distribution. We also provided our own fuel support with two heavy expanded-mobility tactical truck (HEMTT) fuelers.

Most of the power was out in the southern part of the state and cellular telephone usage was difficult because of downed towers. However, we used state-issued 800-megahertz radios and commercial telephones when they were available. Most EWTs used small hand-held radios for close communication between leaders and equipment operators.

We had to address issues of soldier care, including water and meals. We had not sent water buffalos ahead to the area of operations since we had been told that logistical support would come from another battalion that would be collocated with us. A problem was quickly identified when the other unit moved south, but we were able to support our soldiers with organic assets soon afterward. The lesson learned in this situation was to not depend on another unit to support our soldiers' needs unless the unit will exercise total operational control over them for the duration of the emergency. The contract meals issue was resolved quickly by coordinating with the vendor to lower the number of meals provided to the site and coordinating with the state purchasing and contracting office to change the supported unit.

Overall, the relief operations went well, with normal problems that were quickly resolved. Our battalion, and others, received kind words from the communities that we supported. We also took the time to recognize our soldiers, who had done extraordinary work in support of the Hurricane Lili Task Force.

The Hurricane Lili Task Force after-action review is available in Joint Universal Lessons Learned System (JULLS) format through the Louisiana Office of Homeland Security and Emergency Preparedness, 7667 Independence Boulevard, Baton Rouge, Louisiana 70806, <*http://www.loep.state.la.us*>, or Office of the Adjutant General, ATTN: JFHQs (J3), Bldg. #35, Jackson Barracks, New Orleans, Louisiana 70146-0330.

Endnote

[1] CALL Newsletter 93-6, *Operations Other Than War, Volume II – Disaster Assistance*, Fort Leavenworth, Kansas, October 1993, Chapter 6.

Engineer Safety

Wearing Synthetic Fiber Underwear Under the Nomex CVC Uniform

By Mr. Larry T. Hasty

A question that surfaces frequently among combat vehicle crewmen (CVC) is whether it is safe to wear underwear made with synthetic fibers such as polypropylene or polyester under the Nomex® CVC uniform. The answer is no—it can be a safety hazard in a fire.

This includes the new moisture-wicking T-shirt the Army is fielding. Nylon melts at about 480 degrees Fahrenheit, and other synthetics melt at 300 degrees Fahrenheit. Heat transfer through Nomex, which resists temperatures up to 700 degrees Fahrenheit, could be high enough to melt these synthetic undergarments.

An Army chief warrant officer quoted in the February 1995 issue of *Flightfax,* an Army aviation risk management publication, regarding his experience when his aircraft caught fire highlights this safety issue. "My chest, back, and buttocks were spared from any burns at all due to the cotton underwear that I had on. The burn literally went to where the underwear was and stopped. If I hadn't been wearing my Nomex protective equipment and wearing it properly, there is no doubt in my mind that I would very probably have either died in the fire or died as a result of the burns I would have received."

For protection, either wear underwear made of 50 percent cotton and 50 percent wool or of 100 percent cotton. These natural fibers won't melt and will provide protection that will keep the heat away from your body in a flash fire. Recommended items and their national stock numbers (NSNs) are shown in the table.

Keep the Nomex CVC uniform clean. Oil, grease, or household starch will cause the fabric to burn. Dry cleaning or laundering to remove these contaminants will restore the uniform's fire retardant properties.

Don't be the soldier who survives a vehicle fire only to find yourself with melted polypropylene stuck to your skin. Worn properly, the CVC uniform will protect you from burns should the unexpected happen in your combat vehicle. For more information on this subject or other CVC clothing and individual equipment, contact the Assistant TRADOC Systems Manager-Soldier at Fort Knox, Kentucky: Lieutenant Colonel Craig Carson, at (502) 624-3519, DSN 464-3519 or e-mail <*craig.carson@knox.army.mil*>; or Mr. Larry T. Hasty at (502) 624-3662, DSN 464-3662, or e-mail <*larry.hasty@knox.army.mil*>.

NSNs for Recommended Items

Drawers, 100% cotton, cold weather

8415-01-051-1175	X-Small
8415-00-782-3226	Small
8415-00-782-3227	Medium
8415-00-782-3228	Large
8415-00-782-3229	X-Large

Undershirt, 100% cotton, cold weather

8415-01-051-1174	X-Small
8415-00-270-2012	Small
8415-00-270-2013	Medium
8415-00-270-2014	Large
8415-00-270-2015	X-Large

Undershirt, flyers, man, Aramid

8415-01-043-8375	X-Small
8415-00-485-6547	Small
8415-00-485-6548	Medium
8415-00-485-6680	Large
8415-00-485-6681	X-Large

Drawers, flyers, Aramid

8415-01-043-4036	X-Small
8415-00-467-4075	Small
8415-00-467-4076	Medium
8415-00-467-4078	Large
8415-00-467-4100	X-Large

Gloves, combat vehicle crewman

8415-01-074-9428	Size 5
8415-00-074-9429	Size 6
8415-00-074-9430	Size 7
8415-00-074-9431	Size 8
8415-00-074-9432	Size 9
8415-00-074-9433	Size 10
8415-00-074-9434	Size 11

Mr. Hasty is the deputy and senior technical advisor to the Assistant TRADOC Systems Manager-Soldier at the U.S. Army Armor Center, Fort Knox, Kentucky.

Integrated Life Cycle Base Camp Sustainment

By Mr. Richard M. Marlatt

As the Army transforms and expects to occupy a smaller footprint in a theater, strategic base camp planning becomes critical. The current fragmented approach to design, construction, and operation needs to be reengineered to exploit information technology and integrate base camp management throughout the life cycle. The U.S. Army Engineer Research and Development Center (ERDC) has several ongoing efforts to address different components of this challenge.

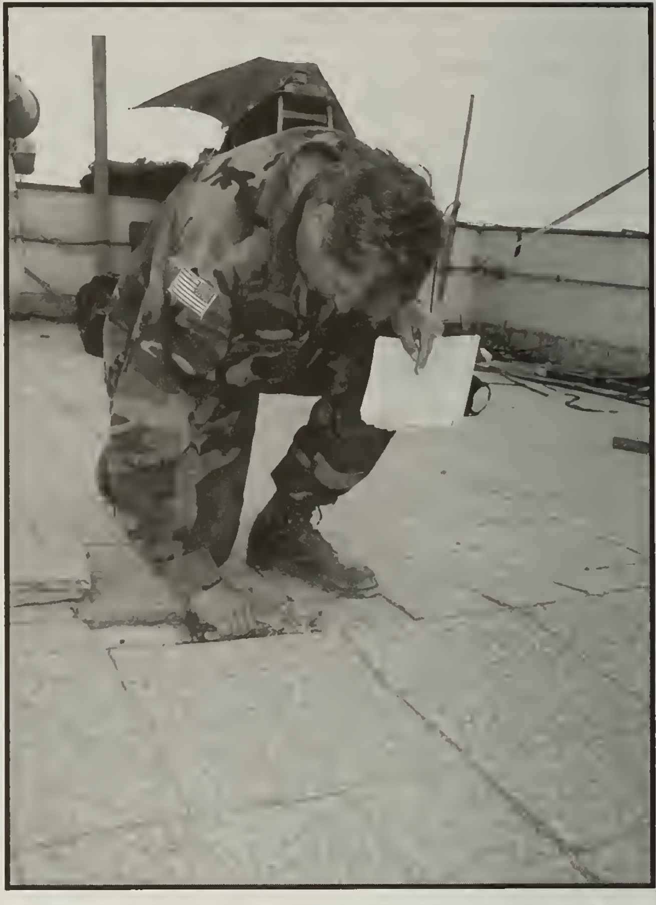
Current Situation

For planning base camps (intermediate staging, forward operating, and forward staging), the Theater Construction Management System (TCMS) is the only automated tool available to military engineers. TCMS, developed by the ERDC Construction Engineering Research Laboratory (CERL) in the 1980s, has been used successfully but addresses only design and construction. Those responsible for theater engineering need the TCMS capability plus a means to make intelligent life cycle base camp sustainment decisions. This includes not only design and construction planning but also force protection; environmental considerations; health and safety issues; and base operation, transfer, and closure.

Doctrine for the design of base camps is weak, although field and technical manuals abound. Site selection techniques are also less than ideal. There is a lack of general engineering, environmental-baseline documentation, and sanitation input. The design is for an initial standard, but it usually becomes a temporary standard. The lack of strategic planning also contributes to high annual operating costs for base camps. For example, Defense Secretary Donald Rumsfeld noted during a June 2001 visit that Camp Bondsteel costs $148 million per year, which resulted in a memorandum to the Secretary of the Army recommending that costs be reduced. Finally, bases take time to deconstruct, and these activities can harm the ecosystem if environmental concerns are not addressed.

An Integrated Process

CERL leads an ERDC project to develop planning decision support tools that provide the forces with an expedient forward infrastructure to meet requirements for rapid deployment, minimal logistics tail, and safe haven. These tools focus on the maximum use of locally available materials, infrastructure, and utilities, resulting in a minimum permanent footprint that meets functional, operational, environmental, and other requirements. The intent is to provide base camp-equivalent facilities within 15 days of troop deployment.



Engineers and troops need a toolkit to help assess existing infrastructure in theater.

A totally integrated base camp facility management decision support tool would encompass general engineering, environmental-baseline information, field sanitation, force protection, and environmental issues over the life cycle of a base camp. Shifting the focus from just initial design to considering operation and maintenance, as well as environmental considerations, in an integrated life cycle manner is a unique and logical way to manage base camps.

The main objective of integrated base camp management is to accommodate a safe, healthy force able to accomplish the assigned mission and maintain combat power. Integrated base camp management will also—

Strategic base camp planning tools will be integrated into the modeling and simulation system of systems.

- Reduce logistic packaging loads (such as fewer shipping containers).
- Decrease costs for land restoration, land damage payments, and equipment maintenance.
- Provide more efficient base camp layouts, improve force protection, and reduce logistics footprint (economy of force). Soldiers get an improved quality of life in theater through rapid planning and time-phased logistics.
- Develop a five-phase base camp master plan within 24 hours of receiving minimal site data.
- Provide the base camp master plan (including a bill of materials) with the minimum construction logistics tail, permanent footprint, and cost within 24 hours of obtaining minimal site data.

ERDC currently has four ongoing projects to develop information, systems, and processes to support this integrated tool. Multiple agencies are involved in these developmental efforts.

Base Camp Planning

Work on this tool began in fiscal year (FY) 01 at ERDC and leverages aspects of the U.S. Air Force GeoReach initiative. A contractor for the Air Force developed a base conceptual planning system called Geographical Base Engineering Survey Toolkit (GeoBEST). The ERDC work focuses on developing sustainment models to rapidly assess mission needs and generate facility requirements for adjacency, minimum standoff, and utilities; constraint-based layout techniques that support rapid base camp planning and dynamic reconfiguration; and an underlying facility model that supports automatic explosive threat analysis and environmental-baseline data.

The intent is to enhance the Air Force tool with decision-support technologies developed for conventional continental United States (CONUS) facility planning, design, and construction—as part of the CERL engineering automation research—and with antiterrorist, logistics, and other military engineering tools from the ERDC Geotechnical and Structures Laboratory (GSL). This work is also being coordinated with the U.S. Army Engineering and Support Center, Huntsville, Alabama.

GeoBEST will include interfaces to existing ERDC tools, including the Antiterrorist Planner, TCMS/Army Facilities Components System (AFCS), TeleEngineering Toolkit, Terrain Modeling System, and Mobile Combat System–Engineer (MCS–E).

This decision-support tool will help military engineers develop a comprehensive list of facility and infrastructure requirements and then decide where and how best to provide those facilities using a three-dimensional, georeferenced map of the site. The planner will be able to construct alternative scenarios and compare the time, cost, and logistics required to modify or upgrade existing facilities with the construction of rapidly erectable temporary facilities.

Conventional Contingency Facilities

This ERDC project identifies Class IV reduction opportunities for conventional semipermanent construction. Currently, the construction of buildings in theater takes too long, costs too much, and ties up critical transportation resources. Previous contingency operations (such as up to 24 months in duration) have shown that forward operating base vertical construction materials constitute one-third of the Class IV supplies.

> "Integrated life cycle base camp management tools support Army Transformation objectives by providing better-designed contingency facilities faster, with less logistics tail and a smaller footprint, and at the lowest cost to ensure the soldiers' comfort, health, safety, and combat readiness."

The South East Asia (SEA) hut, a commonly used semi-permanent construction facility, is the initial case study for this work. SEA huts use standard dimensional lumber and plywood construction and have been built for base camps in Vietnam, Kosovo, and Guantanamo Bay. They provide adequate shelter against the weather and are a temporary solution to housing forces for operations that exceed six months in duration. However, this conventional construction requires large quantities of Class IV supplies that generate logistical problems.

ERDC is exploring optimum-value engineering and materials substitution for designs that can reduce the Class IV burden. Optimum-value engineering will eliminate unnecessary design redundancies. Innovative materials substitution focuses on researching standard and hybrid sections (such as engineered wood composite) to develop new sections that inherit the best properties of their components. From the research, various design configurations will be generated and their subsystems evaluated. The capacity of these subsystems will be assessed against their construction weight, volume, and constructibility requirements.

Contributors to be brought on board when appropriate include the ERDC-GSL Base Camp Survivability Branch for materials procurement knowledge, the U.S. Army Engineer School for engineer training doctrine, the 412th/416th Engineer Commands, the Naval Mobile Construction Battalion and/or the Air Force RED HORSE Civil Engineering Squadron units for combat construction doctrine and knowledge, the Huntsville Center for logistics and forward operating base requirements, and Kellogg, Brown & Root for practical contractor experience.

In-Theater Infrastructure Assessment

One way to support rapid military deployment and reduce the Class IV materials needed in theater operations is by using or adapting the existing infrastructure. To ensure the adequacy of this infrastructure, theater engineers need tools to locate, inventory, and assess the condition of buildings and utilities. As part of this effort, ERDC is studying the feasibility of using remote assessment of the infrastructure to identify, sort, prioritize, and make initial evaluations. Once on the ground, the troops and engineers could perform more detailed inspections using simplified methods, checklists, design and material libraries, and a centralized reachback capability with skilled engineers who assist in finding and resolving complex problems.

The scoping phase of this project is looking at multiple approaches that would help engineers and troops in the field better use the existing infrastructure. A close look at lessons learned from recent mobilization efforts will be an important early step. Proponents within the Department of Defense will be identified and invited to participate in a base camp workshop scheduled to take place in FY04. The lessons learned, workshop, and investigation of current standards and promising technologies will focus the research efforts where the most effective improvements can be made. The following activities are being considered:

- Develop a database (or the framework and tools for collecting the data) of existing infrastructure outside CONUS.
- Establish infrastructure benchmarks based on local practices.
- Develop applications of remote assessment technologies for buildings and utilities.
- Develop assessment tools for engineers (building component inventories, inspection checklists, guidance, and self-contained reference materials).
- Develop assessment tools for soldiers (simplified methods).
- Produce standards for gathering information to optimize use of the ERDC TeleEngineering Operations Center.
- Provide rapid restoration techniques for utilities and buildings.
- Document innovative repair methods (such as using indigenous resources).

The findings will be used to focus research and development on tools that will assist in rapid theater inventory, condition assessment, planning, and repair of existing structures to meet the functional demands.

Utilities Technology Selection

During deployments, the Army establishes base camps in a wide variety of situations. Site conditions, such as the status of existing infrastructure and the environmental-baseline assessment, affect how base camps can be deployed and how utilities can be provided. Because each base camp scenario is unique, the Army must depend on an array of utility technologies to serve base camp needs. Selection is based on preexisting site conditions, the environmental-baseline assessment, the number of troops, and the duration of the stay.

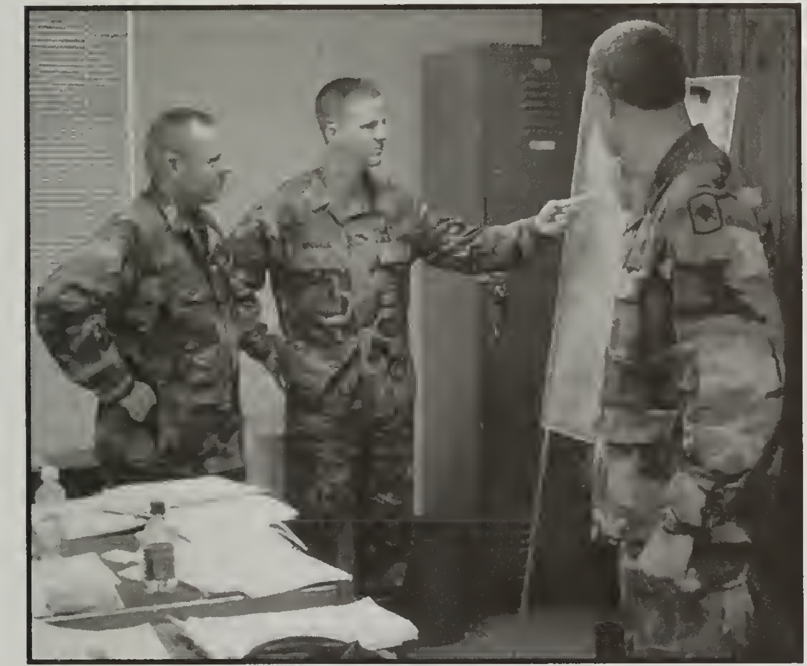
(continued on page 43)

AC-RC in the 21st Century
(From an AC Perspective)

By Captain Jason Meharg and Captain Michael Konczey

Many in the armor and engineer communities—and the Army community in general—perceive Active Component (AC)-Reserve Component (RC) assignments to be the "kiss of death" for their careers. Others see them as a sign that they have done something wrong and are no longer worthy of the more prestigious assignments, such as small group instructor (SGI) at a branch school or observer-controller (OC) at a combat training center. To dispel this perception, the Armor and Engineer Branches even state on their respective home pages, "The general rule is not *if* you will serve, it's more like *when* will you serve"[1] in an AC-RC assignment and "Most officers will be assigned to a '3R' (recruiting, Reserve Officer Training Corps, Reserve Component) assignment. The 3R assignment itself has no negative bearing on promotion, schooling, and battalion command."[2] While there are some disadvantages to an AC-RC assignment, we submit that these assignments are not career-enders and that the rewards far outweigh the challenges. The intent of this article is to address some of these challenges, highlight some of the rewards, and perhaps change the perception of AC-RC assignments across the force.

Within the AC-RC community, there are two different paths: First, there is the resident training support battalion. These units cover down with only one RC unit. Second, there is the observer-controller/trainer (OC/T) battalion. These units evaluate and assist in training several RC units within a specified region. This article focuses on the training support battalion.


National Guard troops conduct a map reconnaissance for an upcoming training event with their resident trainer.

Despite the negative connotations and personal feelings regarding AC-RC assignments, they remain a necessary, important, and rewarding aspect of the total Army assignments process. First and foremost, the AC-RC program is congressionally mandated and requires the Army to "provide Active Component advisors to Army RC units to improve readiness. As a result, AC-RC assignments are placed first or second on the priority list of fill."[3] These assignments are also important because the officers and noncommissioned officers (NCOs) who fill them play important roles in the personal and professional development of the supported RC units. Lastly, these assignments help AC soldiers understand how the RC functions. As we move more to an "Army of One," it's likely that many AC leaders will either work for or have RC units working for them in future deployments.

Since Operation Desert Storm in 1991, and the drawdown at its conclusion, the Army National Guard has continued to play an increasingly larger role in the U.S. Army's power projection capabilities. The National Guard has participated in Operations Southern Watch, Northern Watch, Joint Forge, Joint Guardian, and Deliberate Forge, to name just a few. In 2000, the 49th Armored Division took the lead in Bosnia for Stabilization Force 7 Operation Joint Forge, Multinational Division-North. This deployment marked the first time since American soldiers entered Bosnia in late 1995 that an Army National Guard unit served as the headquarters element and provided a troop component for this peacekeeping mission.[4] National Guard units continue to perform this mission today.

Since 11 September 2001, RC units have taken on even larger roles, ranging from Homeland Defense, to the United Nations Multinational Force Observer Mission in the Sinai, to operations in combat theaters of Operation Enduring Freedom in Afghanistan and Operation Iraqi Freedom. Currently, RC units provide the majority of operational and theater-level logistical support and maneuver control for combat operations. RC units are the primary force running aerial port of debarkation operations in Uzbekistan. Similarly, RC units provide the majority of transportation assets in Kuwait. More significantly, follow-on forces for the next phase of Operation Iraqi Freedom will include RC combat units in addition to the many combat support and combat service support units already in theater. The 39th Infantry Brigade (Enhanced Separate Brigade), Arkansas Army National Guard, and the 30th Infantry Brigade (Enhanced Separate Brigade), North Carolina Army National Guard, recently received mobilization orders to deploy to Iraq with 1st Cavalry Division and 1st Armored Division, respectively.

Serving in an AC-RC assignment presents many challenges and rewards. First, we work on a daily basis with the supported RC unit. We work in their armories and live in the same communities. Our mission is to—

- Provide military occupational specialty (MOS)-specific training assistance to the leaders and soldiers of the unit.
- Focus efforts in planning, executing, and evaluating battle-focused training to improve the combat effectiveness of the company/battalion/brigade and to reduce post-mobilization training time.
- Perform duties as directed by the AC commander.
- Fill key vacancies and deploy with the unit, on order.

We assist the unit in planning, preparing, and resourcing their training. We help ensure that their training is battle-focused and in line with the guidance issued by their higher headquarters. We coordinate for outside support in the form of OC/Ts for their externally evaluated lanes and annual training. Often, we assist the OC/Ts in planning and resourcing this training, as well as issuing the operations orders and maneuver graphics for these exercises. We also play a vital role in planning and preparing yearly training briefs that culminate in annual training, combat training center rotations, and/or real-world deployments. In short, we assist in the planning, preparation, and execution of training at all levels for the supported RC unit. Of course this helps the unit as well as our own professional growth. Our bottom-line objective is to ensure that the unit is ready to deploy when the nation calls.

As part of training the unit, we help educate the RC soldiers and leaders we support. We teach officer and NCO professional development and other classes; assist platoon leaders, platoon sergeants, and junior NCOs in devising training for their soldiers; and even have the opportunity to develop soldiers on an individual level. In addition, we assist the supported RC unit in training, evaluating, and validating platoon leaders, platoon sergeants, and company commanders, focusing on their ability to issue operations orders, conduct troop-leading procedures, give after-action reviews, and conduct proper risk assessments.

Our presence in these assignments is a delicate balance. We are expected to be the subject matter experts in many areas. Similarly, we are expected to share this expertise with the supported RC unit with the expectation that they will incorporate what is applicable. This does not always occur, however, mostly because we are outsiders; we are not members of the tight-knit RC family. It is important to keep in mind that success in this assignment is measured in small bites. We must establish our credibility—as with any new unit—and cultivate a relationship of trust to be truly effective. Therefore, we must maintain the technical and tactical competence that is expected of us as professional officers and NCOs. We must also maintain our doctrinal knowledge and stay current within our respective branches (which can be difficult being located in such far-removed locations). By doing all of these things, we again benefit the unit as well as ourselves.

National Guard troops review personal data before deployment.

By and large, we work with a large, professional group of soldiers. National Guard soldiers are consistently willing to listen to new ideas from the training support battalion as well as the OC/Ts and incorporate these ideas into their next training event. They are motivated, patriotic, willing to do the right thing, and ready to fight to protect America.

In addition to the opportunity to help make the National Guard units better, one also gains a better—and necessary—understanding of how the National Guard works. This assignment gives firsthand insight into the constraints the units face, as well as how competent they are despite how little time they actually spend in uniform. When it comes to external evaluations, either during monthly drills or annual training, they are held to the same standard as AC units. The biggest difference is the amount of quality training time available to the RC unit. Like AC units, RC units still have annual maintenance, mobilization, and inspector general inspections, as well as individual common task training, Army physical fitness tests, and weapons qualifications. But unlike AC units, RC units are authorized 48 multiple unit training assemblies (weekend drills) a year, resulting in just 24 eight-hour days to conduct all of their administrative and training requirements in preparation for their annual training.

Another advantage is the opportunity to assist in the personal and professional development of soldiers, which is always rewarding, no matter which patch they wear. Other benefits include unparalleled family time and the opportunity to further one's civilian education.

While AC-RC assignments have many personal and professional rewards, they also have a few disadvantages. Often, we work in remote areas that lack the military support channels we have grown accustomed to when living on or near a military installation. There may be no military medical or dental facilities, no commissary or post exchange, no military barbers, and no military dry cleaners. Some live and work in communities that lack the TRICARE Health Care Program or TRICARE Prime Remote providers. Some live in areas with inadequate housing and schools for family members (situations that are being addressed). But most importantly, we miss out on the routine life on a military installation. Like recruiters, we lose the everyday camaraderie with our work groups, peers, and other Army families.

As with any military assignment, there are good and not-so-good aspects. An AC-RC assignment has many more good points than bad, providing the AC participant with opportunities not often available in other assignments. The opportunity to professionally develop by "rebluing" on doctrine and tactics, techniques, and procedures; pursue civilian education; spend time with your family; and live in a civilian community are once-in-a-career opportunities. Most importantly, you can have a huge impact on the readiness of many soldiers who may be deployed, with little or no notice, to real-world missions all over the globe. AC-RC assignments are not a fad, nor are they anathema. The important thing is to keep such assignments in perspective. Any assignment, if analyzed enough, can reveal something to complain about, but remember that we all chose to serve. Lastly, remember the 1st Infantry Division's motto: "No mission too difficult, no sacrifice too great, duty first."

Endnotes

[1] Armor Branch Web site at <*https://www.perscomonline.army.mil/OParmor/arcpt_old.htm*>

[2] Engineer Branch Web site at <*https://www.perscomonline.army.mil/OPeng/BQassign.htm*>

[3] Armor Branch Web site at <*https://www.perscomonline.army.mil/OParmor/arcpt_old.htm*>

[4] MAJ Ron Elliot. "49th Armored Division deploys to Bosnia." *ArmyLINK News* February 15, 2000.

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("Base Camp Sustainment," continued from page 40)

ERDC will prepare a matrix of base camp technologies that can provide utility services for water treatment and distribution, wastewater collection and disposal, solid waste disposal, and electrical-power generation under various deployment scenarios. Information in the matrix comes from a study completed in FY02, deployment doctrine, agencies active in supporting Army deployments, and military and civilian individuals with deployment experience. The matrix includes existing technologies, technologies under development, and commercial off-the-shelf technologies that could be adapted to deployment scenarios.

Based on the matrix, ERDC will estimate the impact that existing technologies have on deployments and determine the potential impact of replacing ineffective technologies with more effective ones. Evaluation of this impact will be based on mission, deployment logistics, cost, security, and quality of life for the soldier.

In the next phase of the research, ERDC will develop—or partner in the development of—technologies necessary to fill high-priority elements of the matrix. It is anticipated that technologies related to solid waste processing and wastewater sludge disposal will be developed. However, it is possible that other technology gaps with higher priority will take precedence. Any new technologies developed will be field-tested and validated before recommendation.

For this work, ERDC will consult or partner with other Corps of Engineers offices and laboratories; the Soldier Support Center at Natick Laboratories, Massachusetts; and the Air Force Research Laboratories at Tyndall Air Force Base, Florida.

Conclusion

Integrated life cycle base camp management tools support Army Transformation objectives by providing better-designed contingency facilities faster, with less logistics tail and a smaller footprint, and at the lowest cost to ensure the soldiers' comfort, health, safety, and combat readiness. Through an integrated approach, environmental, communications, force protection, and other issues can be considered simultaneously in planning and management rather than piecemeal or after the camp is built. These tools will help ensure base camp sustainability from design through disposal.

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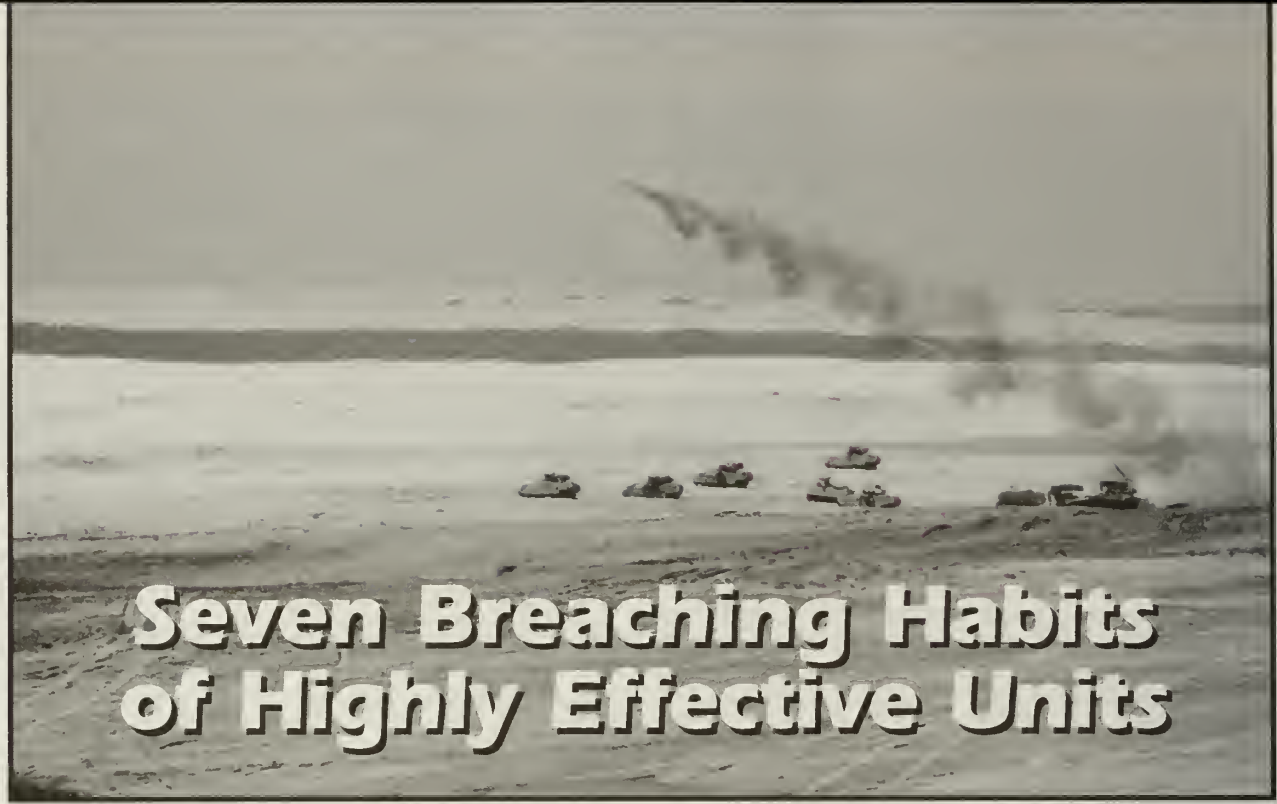

Seven Breaching Habits of Highly Effective Units

By Lieutenant Colonel Thomas H. Magness

Mobility is Job No.1. Without it our forces will go nowhere. However, enemy forces throughout history have found numerous methods of blocking roads, creating barriers, and limiting the movement of advancing forces. In turn, great armies have conducted combined arms breaching operations to overcome these obstacles to press the fight and destroy the enemy. The orchestration and execution of this task may be the toughest job a maneuver commander will ever face. The purpose of this article is to assess breaching operations based on lessons learned at the National Training Center (NTC), Fort Irwin, California, while also revealing the "Seven Breaching Habits of Highly Effective Units."[1]

In 1999, the Training and Doctrine Command (TRADOC) developed a trends-reversal program to review unit execution of numerous mission-essential tasks. One task, combined arms breaching, was high on the list for review and assessment. TRADOC designated NTC Rotation 00-10 as a combined arms breach-focused rotation and coordinated with the U.S. Army Engineer School to assess negative trends in breaching operations. This onerous task, executed by some tremendous maneuver and engineer leaders, validated one thing—the trend has not been reversed.

Combined arms breaching operations are difficult and remain a negative trend. This is no surprise to warfighters anywhere and is echoed by the Sidewinder (Combat Engineer) Observer-Controller Team at NTC. Opposed combined arms breaching, under fire, against a capable opponent like the NTC Opposing Force (OPFOR), is tough but not impossible.

Field Manual (FM) 3-34.2, *Combined Arms Breaching Operations* (formerly FM 90-13-1), says that breaching "is perhaps the single most difficult combat task a force can encounter."[2] The May 2001 issue of *Engineer* indicates that it took the U.S. Marines 2.5 to 9.5 hours to clear two lanes through an Iraqi obstacle belt during Operation Desert Storm.[3] It took another 24 to 48 hours for friendly elements to pass through the obstacle and continue their movement toward the enemy. This was an unopposed breach with the best available equipment, personnel, and planning and had been rehearsed for weeks.

We can and must reverse this trend. Many rotational units with great leaders, adequate equipment, and strong motivation culminate at the breach and never pass combat power to destroy the enemy. Some units never even get to the breach or cannot identify where or how to breach. This is despite the fact that breaching is the top deliverable for combat engineers and brigade combat teams (BCTs) in mid- to high-intensity combat operations. Combined arms breaching may be the ultimate team sport, and success relies on the skill, techniques, and training of all the players, not just the engineers.

Trends – What We See

First, I'll present a quick review of the combined arms breaching trends seen at NTC, based on observations during the planning, preparation, and execution of combined arms breaching operations. Repeated failures occurred in:

Planning

- Reconnaissance and surveillance (R&S) planning, and intelligence requirements are unfocused.
- Poor terrain analysis fails to answer the "So what?" question.
- Units fail to perform reverse breach planning.

- Units do not make detailed plans to set the conditions for breaching.

Preparation

- Observers fail to provide detailed obstacle intelligence.
- Units fail to interdict enemy engineer defensive preparations.
- Engineer and combined arms units fail to rehearse adequately.

Execution

- Breach execution is unsynchronized.
- Maneuver forces lack mass and move forces into the breach piecemeal.
- Maneuver forces "stumble" into obstacles.
- Engineers are not in position when conditions are set.
- Units fail to consider traffic control or expansion of lanes.

> "I approve of all methods of attacking provided they are directed at the point where the enemy's army is weakest and where the terrain favors them the least."
>
> Frederick the Great

Seven Breaching Habits of Highly Effective Units

Habit No. 1 – Mass Kicks A**!

Habit No. 2 – Focus on the Enemy Engineers.

Habit No. 3 – The "Orchestrated Ballet of Farm Implements" Doesn't Just Happen.

Habit No. 4 – Don't Call Them Farm Implements!

Habit No. 5 – Obstacles Are Like Rivers; Learn to Breach or Learn to Swim.

Habit No. 6 – Use All Available Smoke Assets; Someone Is Always Watching.

Habit No. 7 – Breaching Operations in Restricted Terrain Are Not "Business as Usual."

Habit No. 1 – Mass Kicks A**!

Quite simply, most units lack sufficient mass to succeed in penetrating prepared enemy positions. Success or failure can often be predicted at the line of departure (LD) based on this fact alone. In fact, most brigade combat team attacks will effectively mass no more than one company team at the point of penetration. This is clearly not enough to penetrate the prepared fortifications of an enemy who conducts this defense mission three times to every one OPFOR regimental attack. This enemy is good. We should expect no less from our next enemy, wherever we may meet him. We should expect complex obstacle fortifications with antitank and antipersonnel mines, ditches, wire, booby traps, antihandling devices, and whatever else the enemy can muster. Behind this line of obstacles, we can expect prepared fighting positions for both vehicles and personnel with interlocking fires, interior repositioning lines, and the massed effects of as many forms of contact as possible. We should not expect to be successful in this scenario without the massed effects of fire, maneuver, and every Battlefield Operating System (BOS) in the unit.

The standard for mass is articulated clearly in FM 3-34.2:

- Breaching is conducted by rapidly applying concentrated efforts at a point to reduce the obstacle and penetrate the defense.
- Massed combat power is directed against the enemy's weakness.
- The location selected for breaching depends largely on weakness in the enemy's defense, where its covering fires are minimized.
- If friendly forces cannot find a natural weakness, they create one by fixing the majority of the enemy force and isolating a small portion of it for attack.[4]

Tactics, techniques, and procedures (TTP): Conduct detailed terrain analysis. Answer the "So what?" question. We are beginning to see units leveraging the technological advances of terrain visualization tools. The products from TerraBase®, the Digital Topographic Support System, and other visualization tools are just that—products. But with analysis comes answers to the question that maneuver commanders must demand: Where can we concentrate efforts against an enemy weakness, and where are the enemy's covering fires minimized? If a weakness is not identified, where must we create one? Where does the terrain facilitate the positioning of support forces? Where is the enemy's "red zone," and how can we stay out of it? The scheme of maneuver, scheme of fires, task organization, and BOS focus await the answers to these questions.

TTP: Plant the big fat tack (BFT). Mass on the point of penetration. We use a BFT (an extraordinarily big-headed pushpin) to help focus the planning and execution on the point of penetration. It is a great tool to ensure focus at the point where we must have massed effects. Take a look at your plan—how many maneuver units are focused at that point? Is every BOS focused at that point to ensure success? Is that point an enemy weakness? If not, how are we creating one there?

- When do we place the BFT? Early enough to ensure the massed effects of maneuver, fires, and every other BOS. In other words, before we finalize the friendly course of action (COA).

- Who (which BOS) is focused at the BFT? Who isn't?
- Can we adjust the BFT location? Of course. As information changes our understanding of the enemy, we will adjust the BFT location. Use this to trigger a resynchronization of the plan. Tactical operations center (TOC) battle captains and executive officers must ensure that we have a battle drill to confirm focus at the BFT through execution.

TTP: Isolate the point of penetration. Wherever we penetrate the enemy, we must ensure that the remainder of the OPFOR remains fixed. We do this with fires, close air support, maneuver, and scatterable mines. We must do this, however, without violating the principle of mass. The OPFOR has great success in the offense, fixing its Blue Force (BLUEFOR) enemy with motorized rifle companies and scatterable mines. The OPFOR does so without significantly reducing its ability to mass at the point of penetration. All too often, BLUEFOR units commit battalion task forces to this task—often one-third to two-thirds of their total BCT combat power.

TTP: Mass engineers at the breach. Breaching doctrine basically requires one engineer platoon (with attachments) to execute one lane. There is also a requirement for redundancy—typically 50 percent. In a maneuver task force supported by an engineer company, most of that company is required at the breach. Develop a scheme of maneuver and a task organization that masses engineers at this critical point. Identify triggers to change task organization as required to mass engineers at the breach and incorporate them into the decision support matrix.

Habit No. 2 – Focus on the Enemy Engineers

In postmission summaries at NTC, we often quote from FM3-34.2: "An unverified enemy template can lead to disaster because the force may aim an attack at the wrong place. Units may deploy to reduce expected obstacles early, wasting mission time to feel their way into nonexistent obstacles; or they may blunder into an unexpected obstacle or an enemy engagement area."[5] Attacking units routinely have little or no knowledge of how the defending enemy is shaping terrain with obstacles, and engineers are usually committed to breaching operations with very little information on the obstacles they are tasked to breach. It is this shaping of the terrain that will tell the story of how the enemy is defending, and where. Engineers, even enemy engineers, don't lie. They cannot—it simply goes against their nature. An obstacle on the ground means something. It probably means that, were you to back up to two-thirds of maximum effective enemy weapons range (typically 1,200 to 2,000 meters), there will probably be an enemy position. Terrain visualization tools can help confirm or deny these locations (more "So what?" questions).

Too often, we do little to find these enemy obstacles even though they are the one component of the enemy defense that can most easily be detected. They can be spotted during the day or night and are most easily detected during the construction of the obstacle. Men and machines are working, vehicles with supplies are forward, and the terrain is changing shape. Finding precise enemy positions, however, is very difficult. Most OPFOR positions are occupied for only a brief period during defensive preparation (position proofing, rehearsals, security operations), and then not occupied again until just before contact. Most R&S efforts focused on finding the enemy in those positions are unsuccessful because the enemy is simply not there.

TTP: Kill the enemy engineers. Enemy engineers will die. Kill them. Position observers early to detect and disrupt the enemy's defensive preparations. Target bulldozers, caches of construction material and ammunition, engineer soldiers and equipment, and all obstacle emplacement activity. The enemy's ability to disrupt our attacking formations and reduce our momentum is directly related to his ability to successfully emplace his obstacles. He knows he cannot defeat the BLUEFOR in a direct-fire battle without his battlefield shapers. Deny him this advantage. Mine emplacement now is a low-risk, high-payoff mission. We must reverse this, making it a high-risk mission for enemy soldiers to employ mines. When an enemy soldier gets the mission to emplace mines, he must tremble with the thought of his impending destruction.

TTP: Find the obstacles. This cannot be just an engineer reconnaissance task. This is something on which we must focus combat observation lasing teams (COLTs), Stryker vehicles, brigade and task force scouts, unmanned aerial vehicles, the Joint Surveillance Target Attack Radar System (JSTARS), and any other available "lookers." Find the obstacles to confirm or deny the enemy COA. Confirm the proposed point of breach or penetration. Consider layering reconnaissance assets by sending in initial forces to identify obstacles, with subsequent forces to obtain (before committing breaching forces) precise information such as—

- Obstacle location and type.
- Gaps and bypasses.

- Specific minefield composition, which may dictate what breach assets to use and in what sequence.
- Soil conditions, which may indicate suitability for plowing.

We do not have the technology to detect buried mines and many other low-cost, low-technology explosive devices. Therefore we must compensate for this with TTP, task organization, and focused reconnaissance. To be successful, we must focus all available lookers to let us detect mining activity and enemy obstacles before they are emplaced. (See "Kill the enemy engineers" on page 46.)

Habit No. 3 – The "Orchestrated Ballet of Farm Implements"[6] Doesn't Just Happen

FM 3-34.2 indicates that the "commander ensures synchronization through proper planning and force preparation. Fundamentals to achieve synchronization are—

- Detailed reverse breach planning.
- Clear subunit instructions.
- Effective C2.
- Well-rehearsed forces."[7]

The first two are fairly straightforward and are articulated very well in our breaching doctrine. Reverse breach planning works—do it! Determine the force ratios required on the objective and work backward through the breach to the LD. Assign clear tasks and purposes to all subunits with graphic and fire-control measures and triggers that take the unit from LD through the objective.

TTP: Command and control (C2). Ensure, as a minimum, that the following are clearly addressed in the plan and then rehearsed:

- Who determines that conditions are set?
- Who initiates the smoke (artillery and mechanical)?
- Who adjusts and controls the smoke?
- Who chooses the specific breach location?
- Who controls the breach assets?
- Who shifts suppressive fires?
- Who guides assault forces to the breach?
- How and when do we communicate this information, and on what nets? How do we do this digitally?
- Who is the breach force commander, and have we resourced him (without exceeding span-of-control considerations) to be successful?

> "A poor plan, well rehearsed and violently executed, is better than a perfect plan late and unrehearsed."
> General George S. Patton

TTP: Conduct combined arms, mounted suppress, obscure, secure, and assault (SOSA) rehearsals. You may be surprised to see the "R" (reduce) missing from the breach fundamentals acronym SOSRA. This is the one component that least needs rehearsal. It is the bread-and-butter battle drill for the engineers, but it is the one that has received the most attention when units indicate that they have conducted rehearsals. Where synchronization usually fails, and where rehearsals need the most focus, is in setting the conditions (suppress, obscure, secure) and in rapidly projecting combat power (assault) through the breach and onto the objective. Make this the focus of mounted rehearsals. Work through timing, triggers, positioning, and the C2 issues identified in the previous paragraph. Get the engineers to the breach, and they'll do fine.

Habit No. 4 – Don't Call Them Farm Implements!

We all (engineers, maneuver commanders, and Army leadership) recognize that our breaching assets are slow, old, and often inadequate for the assigned breaching tasks. But they're the best the Army gives us, so make them work. Generally, engineer and maneuver leaders fail to understand the capabilities and limitations of our breaching systems, do not identify appropriate commitment criteria for specific systems, and generally underestimate or undersell the capabilities of the most powerful breaching force on the combined arms battlefield—the sapper.

TTP: Fire the mine-clearing line charge (MICLIC). The lethality of the MICLIC should not be understated. It consists of 1,950 pounds of composition A4 and is capable of defeating most pressure-activated mines, clearing a 14- by 100-meter lane. Unfortunately, until sappers go to NTC (or are deployed to a combat theater), they generally have not fired a live MICLIC. Continental United States-based units are authorized only inert line charges, and even then not enough for one per MICLIC crew. This is the equivalent of tank crews achieving "qualification" having fired only practice rounds or, not having fired one themselves, reaching qualification by watching their buddy fire one. Needless to say, there are a host of issues associated with the firing of 1,950 pounds of explosive attached to 550 feet of cabling and electrical wiring. Work through them. Consider the following:

- In the rough, broken terrain that will likely characterize much of the ground surface on current and future battlefields, slow down. Consider putting the MICLIC on a good road or trail, or pick a point of breach that is suitable for the speeds and launch angle you require (more "So what?" questions for your terrain analysis).
- The MICLIC will destroy most pressure-activated mines in the 14- by 100-meter lane. Some mines in the lane may be unaffected by the blast effect of the charge. That is why we proof, using either rollers, mine plows, or sappers. That is also why we conduct detailed, specific reconnaissance at

the point of breach—to determine the type of mine and the suitability of the MICLIC as a primary breaching system.

- Until the Army fields a better system, the MICLIC is still the most capable breaching asset in the inventory that allows breaching without exposing soldiers to the risks of dismounted breaching operations. Know and understand its capabilities and limitations, and find opportunities to increase the tactical and technical proficiency of the soldiers who use it.

> "I've on many occasions wondered what it would be like to be a real soldier...if only I was an engineer."
>
> General George S. Patton

TTP: Never underestimate the breaching capability of a single sapper. There is no obstacle known to man, and certainly none seen on the NTC battlefield, that cannot be breached by an engineer soldier. We use mounted systems (MICLICs, tank plows/rollers, armored combat earthmovers) to provide speed or mitigate the risk to dismounted soldiers. There may be cases where the sapper is the best available breaching option (rough, restricted terrain, for example). And while there are certainly implications for timing, if the sapper is the only available breaching option, we should all be prepared to wait. The alternative—mission failure—is much worse, of course. This relates to the importance of gaining specific intelligence about the obstacle at the point of breach before the sappers arrive. Configuring an appropriate breaching package without losing momentum depends on timely and precise information. Your sappers demand it.

Habit No. 5 – Obstacles Are Like Rivers; Learn to Breach or Learn to Swim

Our breaching tenets, while all appropriate, probably should borrow a few bullets from FM 90-13, *River-Crossing Operations*:

- Surprise.
- Extensive preparation.
- Flexible plan.
- Traffic control.
- Organization.
- Speed.[8]

If units viewed the obstacle as a river that requires the passage of not just the lead maneuver formation but perhaps the entire BCT, division, or corps on one or two narrow lanes, perhaps we would be less inclined to "hand wave" the details of the breach or to push the requirement to "execute the breach" down to the lead task force or company team. There is little margin for error. If successful, we might have one or two 14-meter-wide lanes through which to project combat power. Smoke, dust, direct and indirect fires, scatterable mines, and chemicals all further narrow this margin for error.

TTP: Avoid the frontal attack. While our doctrine indicates that the frontal attack is the least desirable form of maneuver, it is the one most frequently seen at NTC. Find a flank and mass on it. Exploit a weakness or create one. Isolate the point of penetration. BLUEFOR units rarely if ever surprise the enemy but rather "telegraph" their intentions long before the LD. Find a way to tell a deceptive story without losing the ability to mass effects at the BFT. It's no easy task but one the OPFOR routinely executes. Use obscuration during preparations and movement to, through, and beyond the LD to make it difficult for the enemy to determine friendly intentions.

TTP: Plan for traffic control. Get the military police into the fight. Traffic control is a traditional task for military police but one they rarely execute at NTC. There must be a trigger to hand over the cleared lane from the breaching unit's engineers to follow-on military police and/or engineers. BCTs should plan for a forward passage of lines if more than one unit is passing through the lane. Consider detailed march tables with graphic control measures, much like those for a river crossing, that will facilitate the passage without losing momentum.

TTP: Shifts happen. Build flexibility into the plan. Most plans do not survive first contact with the enemy, let alone make it very far beyond the LD. Most units identify branch plans for alternate COAs but generally fail to include BOS implications as they develop these alternate plans. This is also where the TOC battle drill that refocuses all BOS at the revised BFT location must be in place. Regardless of where we breach, all team members must be refocused at the new breach location if it is to be successful.

Habit No. 6 – Use All Available Smoke Assets; Someone is Always Watching

Of the breach fundamentals—SOSRA—the most challenging may be obscuration. Mechanical smokers (wheeled or tracked smoke generators) rarely create the conditions necessary to allow maneuver formations to get into position to breach. Units rarely identify triggers to transition from artillery-delivered smoke to mechanical smoke and even to hand-emplaced smoke (smoke pots). This is one of the most critical components of the breaching operation that needs synchronization and rehearsal.

TTP: Give a clear task and purpose to mechanical smokers. Generally, orders to smoke units read like this: task—smoke; purpose—to provide smoke. Chemical units need a specific target (antitank systems, motorized rifle company- and platoon-sized formations), location (north wall of the valley, map coordinates NV123456), and desired effect (haze, blanket, curtain) to better use their capabilities. Rehearse their positioning within the formation as well as the triggers for employment and transition from one task to the next. There may be several: one to facilitate the movement of support forces into position, another to ease breaching operations, and perhaps a third to help assaulting forces moving through the breach and onto the objective.

TTP: Expend all ammunition. Most units identify appropriate targets and triggers for artillery-delivered smoke. Fewer use mechanical smokers during the approach to the obstacle or at the breach. Very rarely do units employ smoke pots and smoke grenades at the breach—perhaps because it adds to what already is a complicated menu of tasks. Units fail to do so at their own peril. Assume someone is watching and use every available asset to create the necessary conditions for committing soldiers to and through the breach.

Habit No. 7 – Breaching Operations in Restricted Terrain Are Not "Business as Usual"

Too many units fail to account for the implications of restricted terrain in the planning, preparation, and execution of breaching operations. Units cannot approach breaching operations in a defile as if it were an open valley floor. The implications for breach timing, maneuver unit positioning, observer positioning, and breach assets are too critical to overlook. For those who have trained in "Mojavia," visualize breaching operations in Alpha or Bravo Pass, and think about the applications for breaching in Korea, Kosovo, or Afghanistan. FM 3-34.2 (Appendix D) is a good place to begin to examine the implications of restricted terrain and to develop unit TTP and standard operating procedures (SOPs).

TTP: Restricted terrain operations are slow. Plan accordingly. The implications on the time required to maintain suppression, obscuration, etc., while working through a defile are tremendous and must be planned and rehearsed in detail. These are often dismounted operations to clear high ground and, quite possibly, to set support forces on the far side of the obstacle. The terrain may restrict the ability to execute mounted breaching operations, further adding to the timing challenges. All of these details point to a slow, deliberate process.

TTP: Traffic control is critical. Not only is the river long, it's wide and deep. Because defiles may not allow for two-way traffic and may extend for hundreds of meters, or even for kilometers, there is even less margin for error as units move to and through the breach. March tables are critical as are deliberate controls for entering and exiting the breach area.

Making the "Seven Habits" Habits

The challenge for most units is how to translate these habits into executable tasks. In a word—repetition. Units that practice these TTP—incorporating them into battle drills, SOPs, and mission plans—will develop these breaching habits. Multiple repetitions with all members of the combined arms team will make the successful execution of this extraordinarily complex combined arms task more likely.

These habits are designed to facilitate success in the most complicated scenario possible—breaching in contact. The goal must be to set the conditions, according to these seven habits, to breach out of contact with the enemy. Destroy every enemy in and around the point of breach and every enemy that can influence the point of breach—and then breach. Is this scenario possible? Yes. Is it possible without multiple repetitions and the total focus of every team member? Maybe, but not likely.

Ultimately, however, these habits are the responsibility of the breach orchestrator—the unit commander. Translate the TTP and breach habits into clear guidance and intent that focus the entire unit on penetrating the enemy and his obstacles. And while the use of the seven habits will not guarantee success at NTC or on any other future battlefield, their application—coupled with the warrior spirit that our soldiers consistently display—may help units begin to reverse a negative trend and give our force the mobility it requires.

Lieutenant Colonel Magness is commander of the Detroit District of the U.S. Army Corps of Engineers. When he wrote this article, he was assigned to the Sidewinder Team at NTC.

Endnotes

[1] Apologies to Steven Covey, author of *The Seven Habits of Highly Effective People,* Simon and Schuster, New York, NY, 1989. Combined arms obstacle breaching likely requires effective people as well as effective units.

[2] FM 3-34.2, *Combined Arms Breaching Operations,* 31 August 2000, Introduction, p. 1-1.

[3] Colonel Michael K. Asada, et al, "The Grizzly: A System of One," *Engineer*, May 2001, p. 41.

[4] FM 3-34.2, p. 1-11, para. 1-35.

[5] Ibid., p. 1-5, para. 1-6.

[6] Major Harry Green, "The Grizzly and the Wolverine: Alternatives to an Orchestrated Ballet of Farm Implements," *Engineer*, August 1996, pp. 2-6.

[7] FM 3-34.2, p. 1-13, para. 1-46.

[8] FM 90-13, *River-Crossing Operations*, 26 January 1998, p. 1-4.

(Note: A variation of this article was published in the May 2002 issue of *Armor*. The author wrote it while assigned to the Sidewinder Team at NTC. The opinions expressed are those of the author and do not represent the official position of NTC. Even though nearly two years have passed since they first appeared in print, the lessons of the "Seven Breaching Habits of Highly Effective Units" remain relevant. They are consistent with the concept of assured mobility, as well as the lessons learned on our most recent battlefields.)

Doctrine Updates:
A Bridge to the Future Force

By Lieutenant Colonel Reinhard W. Koenig

The recently approved capstone engineer manual—Field Manual (FM) 3-34, *Engineer Operations*—is now accessible on the General Dennis J. Reimer Training and Doctrine Digital Library. Several years in production, this manual provides a holistic construct for engineer operations within the current operational environment. It consolidates FM 5-100, *Engineer Operations,* and FM 5-114, *Engineer Operations Short of War,* and more importantly, links Joint Publication (JP) 3-34, *Engineer Doctrine for Joint Operations;* JP 3-15, *Joint Doctrine for Barriers, Obstacles, and Mine Warfare;* JP 4-04, *Joint Doctrine for Civil Engineering Support;* and FM 3-0, *Operations,* to our manuals. As the Engineer Regiment moves forward from FM 3-34 with implementing manuals, we must build into our doctrine a bridge to the Future Force that will rapidly incorporate future concepts and support the Current Force.

FM 3-34 Changes

Our capstone manual takes into account new concepts, technologies, and requirements and recognizes that the threat is continuously evolving. Written primarily at the operational level of war, it is applicable to commanders—both engineer and maneuver—at all echelons. It also recognizes that we operate in an environment of continuing transformation. Although it is a complete rewrite of engineer capstone doctrine, some key changes are to—

- Establish an engineer mission-essential task list (METL).
- Codify assured mobility.
- Include field force engineering (FFE).
- Recognize maneuver support (MANSPT) as a grouping of combat support functions.

Establish an Engineer METL

The Combined Arms Center published FM 3-0, *Operations,* in June 2001. As part of this effort, it established an Army METL to serve as an operational expression of the Army's core competencies. It also directed Army units to develop their battle-focused METLs in concert with FM 7-15, *The Army Universal Task List*. The table at right shows the Engineer Regiment's METL, which directly supports the Army METL.

Codify Assured Mobility

We codified our role (with other branches) to provide assured mobility to the force and recognized the invaluable role of the U.S. Army Corps of Engineers (USACE) to our nation. For the first time, we link the operational framework of FM 3-0 and the engineer battlespace functions that support the maneuver commander (combat, geospatial, and general engineering) into a construct that allows the force to deploy, move, and maneuver where and when it desires to accomplish the mission. Not to be confused with the Battlefield Operating System (BOS) function of mobility, assured mobility supports the maneuver commander's use of all elements of combat power to achieve decisive, shaping, and sustaining operations across the full spectrum of conflict. The four imperatives of assured mobility are—

- Develop mobility input to the common operating picture (COP).
- Select, establish, and maintain operating areas.
- Attack the enemy's ability to influence operating areas.
- Maintain mobility and momentum.

These imperatives are integrated into the military decision-making process to achieve the commander's intent. Achieving assured mobility rests on applying its six fundamentals: predict, detect, prevent, avoid, neutralize, and protect. They are all applicable from the strategic to the tactical level. They are most clearly defined in Chapter 3 of FM 3-34, and suggested resources to achieve each are shown in Figure 1 (which is Figure 3-3 of FM 3-34). Note that several units used the assured mobility construct with great success in planning and executing Operation Iraqi Freedom.

Army and Engineer Regimental METL

Army Tasks	Engineer Regimental Tasks
Shape the Security Environment	Shape the Security Environment
Respond Promptly to Crisis	Respond Promptly to Crisis
Mobilize the Army	Mobilize Engineer Forces
Conduct Forcible Entry Operations	Support Forcible Entry Operations
Dominate Land Operations	Support Assured Mobility to Dominate Land Operations
Provide Support to Civil Authorities	Provide Support to Civil Authorities
	Provide Quality, Responsive Engineering Services to the Nation

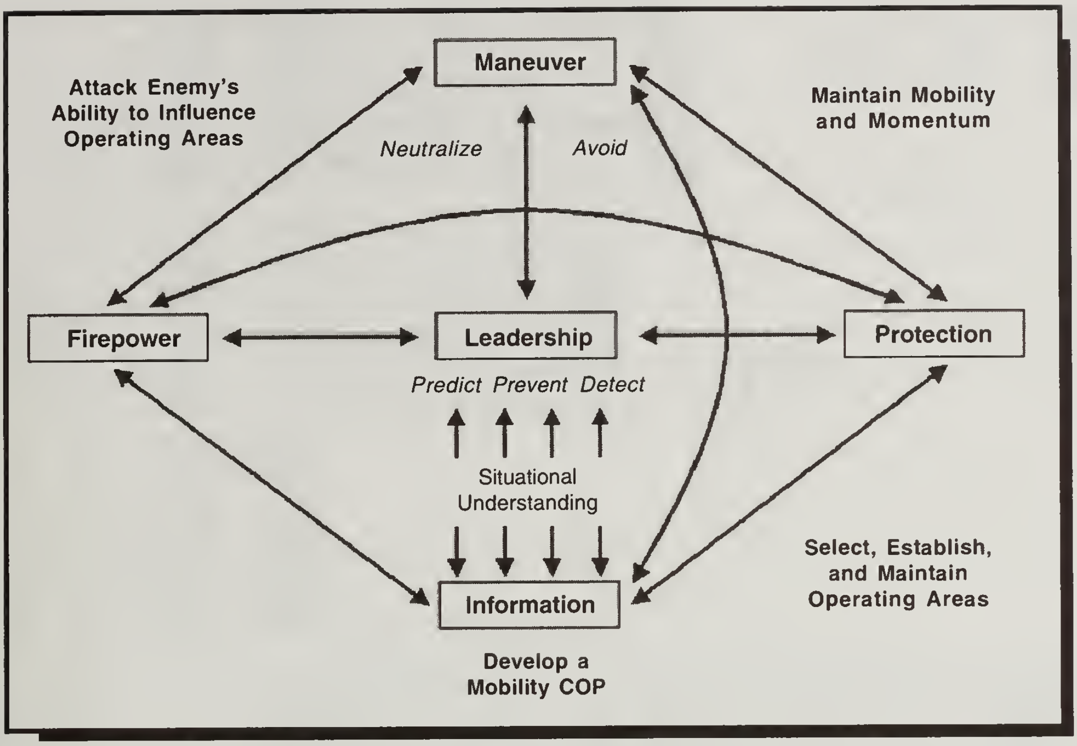
Maneuver
Attack Enemy's Ability to Influence Operating Areas
Maintain Mobility and Momentum
Neutralize
Avoid
Firepower
Leadership
Protection
Predict Prevent Detect
Situational Understanding
Select, Establish, and Maintain Operating Areas
Information
Develop a Mobility COP

Figure 1. Imperatives of Assured Mobility and the Elements of Combat Power (Figure 3-3 from FM 3-34)

Include FFE

For the first time, engineer doctrine recognizes the role of the entire Engineer Regiment in the defense of our nation by establishing FFE as a means to access its specialized engineer capabilities. Particularly early in any contingency, FFE helps to meet the challenge of filling the gap between engineer requirements and assets on the ground. This is done through the combination of *reach* and *forward presence*. *Reach* is the ability of forward-deployed engineer elements to communicate with nondeployed subject matter experts—particularly from the seven research and development centers within USACE—to develop and implement solutions to engineer issues from tactical through strategic levels. The communication system of choice for reach is the USACE-developed TeleEngineering Toolkit. The system proved invaluable at every level during Operation Iraqi Freedom. USACE also operates the TeleEngineering Emergency Operations Center to facilitate reach. *Forward presence* is the deployment and application of modular teams to support the joint force and Army service component commander's needs across the entire battlespace. Drawn mainly from the Engineer Commands (ENCOMs) and USACE, these teams are tailored to meet mission requirements:

- Forward Engineer Support Team – Main (FEST-M)
- Forward Engineer Support Team – Augmentation (FEST-A)
- Contingency Real Estate Support Team (CREST)
- Environmental Support Team (ENVST)
- Base Development Team (BDT)
- Infrastructure Assessment Team (IAT)
- Facility Engineer Group (FEG)
- Facility Engineer Detachment (FED)
- Facility Engineer Team (FET)

Appendix C of FM 3-34 describes the capabilities of each modular team and provides operational guidance for planning their employment.

Recognize MANSPT

MANSPT is the staff integration of the mobility, countermobility, and survivability BOS with the remaining BOS elements focused on enabling assured mobility for the friendly force. It focuses on enhancing tactical freedom of maneuver and force protection using the assured mobility imperatives and fundamentals as the framework. The Stryker Brigade Combat Team (SBCT) currently uses a MANSPT cell that integrates the functions of the Engineer, Chemical, and Military Police Branches, along with explosive ordnance disposal units. FM 3-34 lays out the concept for MANSPT, recognizing it as a future concept that is much broader than the SBCT and encompasses the means to enable, enhance, and protect freedom of action.

These are but a few of the major changes in the Regiment's capstone doctrine. Clearly the culmination of this effort has brought engineer doctrine in line with joint and Army doctrinal thinking and has provided the foundation and blueprint for the Regiment's future doctrinal efforts.

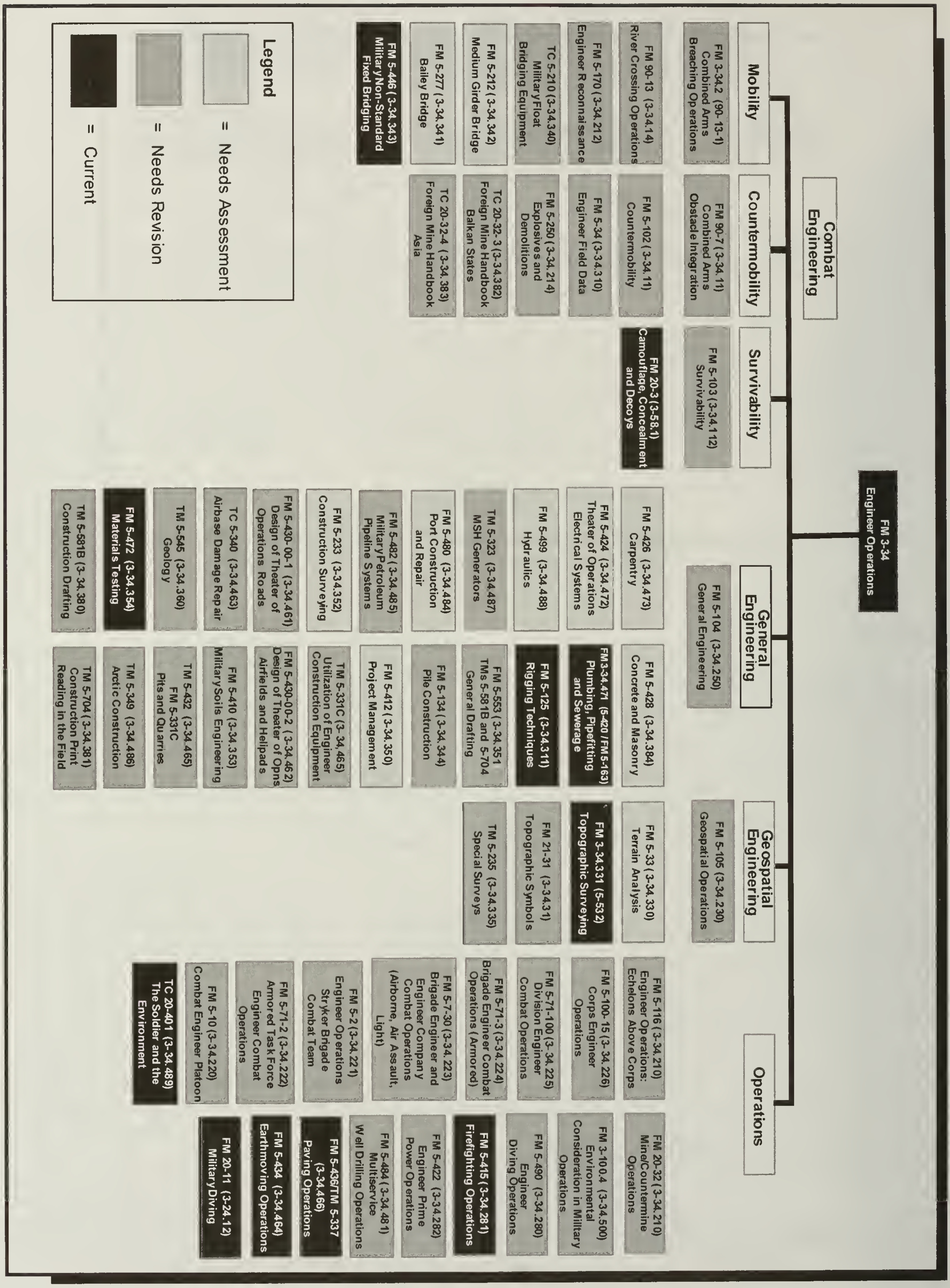
FM 3-34
Engineer Operations
Combat Engineering
Mobility
FM 3-34.2 (90-13-1) Combined Arms Breaching Operations
FM 90-13 (3-34.14) River Crossing Operations
FM 5-170 (3-34.212) Engineer Reconnaissance
TC 5-210 (3-34.340) Military Float Bridging Equipment
FM 5-212 (3-34.342) Medium Girder Bridge
FM 5-277 (3-34.341) Bailey Bridge
FM 5-446 (3-34.343) Military Non-Standard Fixed Bridging
Countermobility
FM 90-7 (3-34.11) Combined Arms Obstacle Integration
FM 5-102 (3-34.11) Countermobility
FM 5-34 (3-34.310) Engineer Field Data
FM 5-250 (3-34.214) Explosives and Demolitions
TC 20-32-3 (3-34.382) Foreign Mine Handbook Balkan States
TC 20-32-4 (3-34.383) Foreign Mine Handbook Asia
Survivability
FM 5-103 (3-34.112) Survivability
FM 20-3 (3-58.1) Camouflage, Concealment and Decoys
General Engineering
FM 5-104 (3-34.250) General Engineering
FM 5-426 (3-34.473) Carpentry
FM 5-424 (3-34.472) Theater of Operations Electrical Systems
FM 5-499 (3-34.488) Hydraulics
TM 5-323 (3-34.487) MSH Generators
FM 5-480 (3-34.484) Port Construction and Repair
FM 5-482 (3-34.485) Military Petroleum Pipeline Systems
FM 5-233 (3-34.352) Construction Surveying
FM 5-430-00-1 (3-34.461) Design of Theater of Operations Roads
TC 5-340 (3-34.463) Airbase Damage Repair
TM 5-545 (3-34.360) Geology
FM 5-472 (3-34.354) Materials Testing
TM 5-581B (3-34.380) Construction Drafting
FM 5-428 (3-34.384) Concrete and Masonry
FM3-34.471 (5-420 / FM 5-163) Plumbing, Pipefitting and Sewerage
FM 5-125 (3-34.311) Rigging Techniques
FM 5-553 (3-34.351 TMs 5-581B and 5-704 General Drafting
FM 5-134 (3-34.344) Pile Construction
FM 5-412 (3-34.350) Project Management
TM 5-331C (3-34.465) Utilization of Engineer Construction Equipment
FM 5-430-00-2 (3-34.462) Design of Theater of Opns Airfields and Helipads
FM 5-410 (3-34.353) Military Soils Engineering
TM 5-432 (3-34.465) FM 5-331C Pits and Quarries
TM 5-349 (3-34.486) Arctic Construction
TM 5-704 (3-34.381) Construction Print Reading in the Field
Geospatial Engineering
FM 5-105 (3-34.230) Geospatial Operations
FM 5-33 (3-34.330) Terrain Analysis
FM 3-34.331 (5-532) Topographic Surveying
FM 21-31 (3-34.31) Topographic Symbols
TM 5-235 (3-34.335) Special Surveys
Operations
FM 5-116 (3-34.210) Engineer Operations: Echelons Above Corps
FM 5-100-15 (3-34.226) Corps Engineer Operations
FM 5-71-100 (3-34.225) Division Engineer Combat Operations
FM 5-71-3 (3-34.224) Brigade Engineer Combat Operations (Armored)
FM 5-7-30 (3-34.223) Brigade Engineer and Engineer Company Combat Operations (Airborne, Air Assault, Light)
FM 5-2 (3-34.221) Engineer Operations Stryker Brigade Combat Team
FM 5-71-2 (3-34.222) Armored Task Force Engineer Combat Operations
FM 5-10 (3-34.220) Combat Engineer Platoon
TC 20-401 (3-34.489) The Soldier and the Environment
FM 20-32 (3-34.210) Mine/Countermine Operations
FM 3-100.4 (3-34.500) Environmental Consideration in Military Operations
FM 5-490 (3-34.280) Engineer Diving Operations
FM 5-415 (3-34.281) Firefighting Operations
FM 5-422 (3-34.282) Engineer Prime Power Operations
FM 5-484 (3-34.481) Multiservice Well Drilling Operations
FM 5-436/TM 5-337 (3-34.466) Paving Operations
FM 5-434 (3-34.464) Earthmoving Operations
FM 20-11 (3-24.12) Military Diving
Legend
= Needs Assessment
= Needs Revision
= Current

Figure 2. Current Status of Doctrinal Manuals

Near-Term Doctrinal Changes

The Engineer Regiment maintains a doctrinal library of 64 products, the second highest number of any branch. Keeping this diverse and often-technical library current requires effort from across the Regiment. Currently, 42 of these products need to be revised. (See U.S. Army Training and Doctrine Command [TRADOC] Regulation 25-36, *The TRADOC Doctrinal Literature Program,* for more on determining the status of a doctrinal product.) Included in this effort is support to Joint Forces Command and TRADOC for the upcoming consolidation of JP 3-34, *Engineer Doctrine for Joint Operations*, and JP 4-04, *Joint Doctrine for Civil Engineering Support.* The good news is that with the publication of FM 3-34, we can begin work on the key implementing manuals:

- FM 3-34.210, *Mine/Countermine Operations* (currently FM 20-32, *Mine/Countermine Operations*). Changes in the contemporary operating environment, equipment technologies, and doctrine make a complete revision necessary. We will use lessons learned from ongoing operations—and include improvements to sapper training involving explosive ordnance—to make this document relevant in the field.
- FM 3-34.250, *General Engineering* (currently FM 5-104, *General Engineering*). Last published in 1986, this FM needs to reflect the advent of FFE, updates to the engineer planning process and joint and Army doctrine, and lessons learned from Operation Enduring Freedom and Operation Iraqi Freedom.
- FM 3-34.11, *Countermobility* (currently FM 90-7, *Combined Arms Obstacle Integration*, and FM 5-102, *(Countermobility*). The consolidation and update of the old countermobility manual into FM 3-34.11 is almost complete. A final draft version is available on Army Knowledge Online (AKO), and comments are welcome.
- FM 3-34.230, *Geospatial Operations* (currently FM 3-34.230, *Topographic Operations*). The revision of this FM will reflect changes in organization, equipment, and lessons learned from an extremely successful topographic effort during Operation Iraqi Freedom.
- FM 3-34.112, *Survivability* (now FM 5-103, *Survivability*). This FM update will reflect almost two decades of advancement in technology and improvements to tactics, techniques, and procedures.

Publication of these manuals is critical to the Regiment, because they serve as the key implementing manuals to execute our battlespace functions of combat, general, and geospatial engineering. They also provide the doctrinal base for our operational and technical doctrinal products. Numerous other efforts are occurring throughout the Regiment. The U.S. Army Engineer School is partnering with many organizations that are stakeholders to produce doctrine that is timely and relevant. Examples include—

- FM 3-34.251 (FM 5-116), *Engineer Operations, Echelons Above Corps.*
- FM 3-34.465 (TM 5-332), *Blasting Operations in Pits and Quarries.*
- FM 3-34.483 (FM 5-422), *Prime Power Operations.*
- FM 3-34.486 (TM 5-349), *Arctic Construction.*
- FM 3-34.280 (FM 5-490), *Engineer Diving Operations.*

If you would like to become involved with assessing, reviewing, or writing any engineer publication, please contact the Engineer School Doctrine Development Division at *<doctrine.engineer@wood.army.mil>*.

Future Doctrinal Changes

Look for doctrine management to transform in the future. Current initiatives at TRADOC include object-based publishing and doctrine taxonomy initiatives that will revolutionize the way we write, produce, and access Army doctrine. More importantly, we must begin thinking now about how and when to codify Future Force concepts into our doctrine. With an initial operating capability of 2008, we must begin developing engineer doctrine for the Future Combat System in 2006 in order to provide the doctrinal bridge between the Current and Future Forces. In the meantime, our current doctrinal efforts must recognize transformation and integrate emerging concepts and technologies as they are developed. Only then will we be able to meet the doctrinal needs of the Future Force.

Lieutenant Colonel Koenig is the Chief of the Doctrine Development Division at the U.S. Army Engineer School, Fort Leonard Wood, Missouri.

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Leadership the "Leahy Way"

By Colonel Gregg F. Martin

One of the most effective NCO leaders I have ever known was First Sergeant Edwin Leahy, Bravo Company, 79th Engineer Battalion, based in Karlsruhe, Germany, with whom I was privileged to serve from June 1984 to November 1985.

"Top" Leahy ran our company with a spirit, enthusiasm, and competence that was unmatched in my experience. Thanks in large part to his phenomenal leadership, Bravo Company excelled at just about everything. It seemed that all we touched turned to gold. The soldiers, NCOs, and officers were fired up with a can-do attitude and sense of pride. Our achievements in war-fighting readiness, training, maintenance, partnership, sports, and community support were usually rated "best in the battalion." We took care of our people and developed them as future leaders. We had fun and enjoyed our time together, whether in the mud, dust, or snow at Grafenwoehr; on the ranges or troop construction missions; in the field; with our allied partnership units; or on the athletic fields. Although Top and I were truly a "team," there was never any doubt in my mind—or anyone else's—that Top Leahy was "The Man."

Let me describe Top Leahy. First, he was an absolutely powerful presence. He exuded confidence, strength, and charisma. He looked old and mean, with a full head of black hair that he slicked back, 1950s style. He had "LOVE" tattooed on one set of knuckles, "HATE" on the other. He grew up in a rough part of New Hampshire and spoke with a thick Northeastern accent. Except for his tour on "The Trail" and some time in jail, he spent all of his Army time down in the trenches, leading engineer soldiers. He was a hard man.

Top was respected, admired, loved, and feared—all at the same time. He loved the company and his soldiers, and no one dared to cross him or mess with his company. His ability to quickly cut through the fog and confusion of events, competing priorities, and complexities never ceased to amaze me. It seemed that a hundred things could be going on, then several crises would hit simultaneously, and Top would instantaneously know what to do, how to do it, and in which priority. He was brilliant. He would run his solution by me for input and concurrence, then we would proceed from there. Despite his tough exterior, he always took time to explain his logic and thought process. In short, he was a wonderful teacher and coach who was developing and mentoring "his" company commander, just as he had mentored his previous commander, then Captain Bob Derrick.

Totally dedicated to the company, the troops, and the mission, Top came to work early and worked a full day. He was always on top of everything in the company and always knew what was happening throughout the battalion. He maintained total "situational awareness" 24/7.

Although we did not have official family readiness groups (FRGs) in those days, Top and his wife did this informally, but most effectively. Mrs. Leahy was the "Company Mom." She pulled together the NCO, enlisted, and officer wives (the company was all-male) on a regular basis to talk business and have fun. The wives became a tight-knit group and took care of their own. She was originally from France, so they had many fun excursions across the border for shopping, restaurants, and sightseeing. When the company deployed, or when tragedy struck, this paid off big time. To this day, my wife says that this informal, close group of wives was the most effective FRG she has ever seen, and the beauty of it was that *they all wanted to get together because it was so much fun.*

Top always loved to have fun. He spoke French and German and was the most enthusiastic participant in partnership activities that I have ever seen. We trained with, did exchanges with, and simply had fun with our allies. Top never saw a partnership event that he didn't like. And I knew that once we went out the door, it was going to be a late night. Wisely, he always brought a designated driver. We built a tremendous amount of good will and truly enhanced our interoperability, which would have paid off in combat if we had ever fought the "big one" in Central Europe. Moreover, he included junior NCOs and soldiers in these events, which was a huge morale builder and one of his ways of growing leaders.

By today's standards, Top's physical condition was not as good as it should have been. Although not a big fan of PT, he was strong and robust and had unlimited energy. There is no doubt that he drank too much and ate too much delicious—but high-cholesterol—foods, and the two packs of unfiltered Camels he smoked every day did not help his wind. When I tried to convince him to change to a healthier lifestyle, his response was, "Life is short, I've already lived longer than I should have, and I actually like this stuff... So thanks, Cap'n, but I ain't changin'." In terms of more running and aerobic fitness, his answer was, "Sir, I've been in combat, and although I did sprint some short distances from time to time, I never ran a long distance anywhere. And if I'm ever in combat again and need to get somewhere, I won't run! If need be, I'll hijack a truck, or cut some poor commie bastard's throat and take his. But thanks for your concern, Cap'n. I appreciate it."

In terms of technical and tactical competence, there was none better. He expertly ran the company with seeming ease. He knew and could execute every mission flawlessly—from weapons to demolition, to construction, to maintenance. In tense situations, I saw him leap into the fray (even if it was mud or wet concrete)—with spit-shined boots and starched fatigues—and take charge to make sure that the mission got accomplished to standard and that no one got hurt. He taught and coached through his personal example. There was nothing he asked his troops to do that he had not already done or wouldn't do again. And they all knew it.

Top always kept mission accomplishment, concern for his people, and loyalty up, down, and sideways in perfect harmony. He intuitively knew how to do this and was a wonderful coach and advisor to his young commander and lieutenants. Given the operational tempo, the number of competing priorities, and the rapid changes that demanded flexibility and adaptability, I would sometimes hit the frustration level and want to go do battle with folks up at battalion. Top was marvelous in calming me down and channeling my energy into more productive venues (and keeping his cap'n "from steppin' on it"). On the other hand, when it *was* time to do battle with higher headquarters, Top let me know, and we often went up to headquarters as a team. And when we did, we rarely lost.

We developed our quarterly training briefs together and briefed as a team from handwritten butcher charts. Top knew exactly how to orchestrate these in such a way that he charmed the battalion commander and command sergeant major and got them to grant Bravo Company much of what we requested. He was brilliant and a true master of how to be totally loyal to me, his soldiers, the battalion commander, and peers. Simultaneously, he could get the battalion commander to love him and the company and give us the resources we requested.

First Sergeant Leahy with author, left, and his other company commander (Colonel Bob Derrick, who was the Bravo Company, 79th Engineer Battalion, commander before Colonel Martin) on the right, dedicating the 79th Engineer Battalion plaque at ENFORCE 2002.

What is the relevance of this story? Top Leahy epitomized the NCO Creed. When I think of professional competence—tactical, technical, and leadership—I think of his calibrated and seasoned eyeball, evaluating any situation thrown at him and instantly knowing exactly what to do and how best to handle it. When I think about how to balance mission accomplishment with the welfare of my troops, I often think of Top Leahy. When I think about knowing my soldiers, keeping them informed, and being fair and impartial, I think of him. Top Leahy showed me how to earn the respect and confidence of my superiors as well as that of my soldiers. His life was an example of loyalty to those with whom he served: "seniors, peers, and subordinates alike." He always took the initiative and never compromised his integrity or moral courage. He was always totally candid, while also being diplomatic when necessary.

In short, Top Leahy lived and modeled—every day—what it meant to be a professional NCO in the U.S. Army. He and his NCOs in Bravo Company gave me and my officers maximum time to accomplish our duties, because we did not have to accomplish theirs. First Sergeant Edwin Leahy showed me—through his life—what it means to be an NCO, "The Backbone of the Army."

(Note: First Sergeant Edwin S. Leahy [1944-2003] passed away recently in Rolla, Missouri. He is survived by his wife Sandy, four children, one sister, and five grandchildren. His protégés from Bravo Company, 79th Engineer Battalion, include—among a large number of great Americans—Colonel Bob Derrick, who went on to command the 307th Engineer Battalion, the 20th Engineer Brigade, and now the U.S. Corps of Engineers Transatlantic Command; and Lieutenant Colonel Clarence "Dave" Turner, who currently commands the 14th Engineer Battalion in Iraq. To this day, the three of us are still in awe of First Sergeant Leahy.)

Colonel Martin commanded the Bravo "Bulldogs," 79th Engineer Battalion, from June 1984 to November 1985, in Karlsruhe and Grafenwoehr, Germany. He currently commands the 130th Engineer Brigade, of V (U.S.) Corps and CJTF-7, in Iraq.

BAD DAY AT DALAT

By Colonel Larry Saul

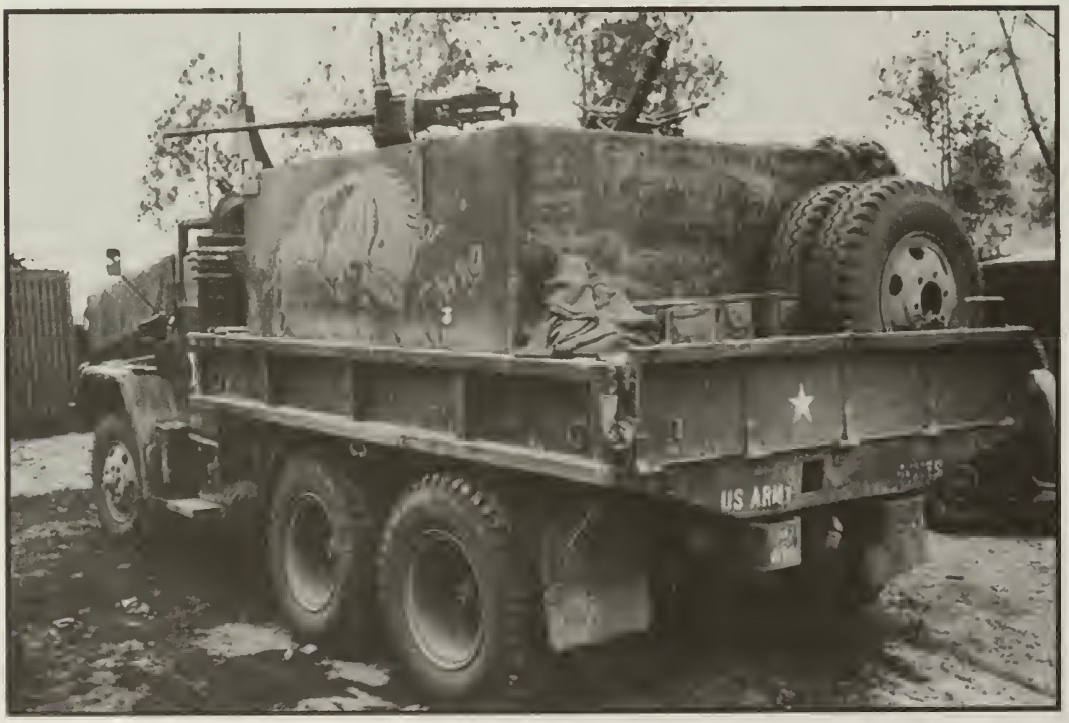
The resounding crash of rocket-propelled grenades (RPGs) and the staccato report of several automatic weapons were the first indications that things had just taken a turn for the worse. It didn't take long to figure out that this was going to be ugly. Along the length of the kill zone, the scene was one of smoke, flame, and bodies lying about—the unmistakable sight of death and destruction. A quick glance revealed that we were pinned down, under highly accurate enemy fire, and had taken numerous casualties. The North Vietnamese Army (NVA) had launched a thoroughly successful ambush against a U.S. unit in the central highlands of Vietnam.

* * *

In early May 1970, Delta Company, 815th Engineer Battalion, assigned to the 937th Engineer Group, 18th Engineer Brigade, and its sister unit, the 102d Engineer Company (Construction Support), moved from the area around Dak To and Kontum, in northern South Vietnam's II Corps, to an isolated base camp adjacent to the inconsequential village of Phu Heip, near the village of Di Linh, Lam Dong Province. Di Linh is situated roughly equidistant between the two provincial capitals of Bao Loc and Dalat, astride national highway QL-20. Dalat is the capital of Tuyen Duc Province and was the home of the Vietnamese National Military Academy and summer home for the president of South Vietnam. This idyllic town had been a tourist destination during the French colonial period. Dalat had a decent, well-maintained airstrip and served as a logistical support base for U.S. units in the area. Supplies and mail were shipped there for distribution. The main class of supply was Class I. For Classes III (petroleum, oil, and lubricants) and V (ammunition), units conducted major resupply convoys to the sprawling logistical support bases at Cam Ranh Bay or Long Binh. A rudimentary post exchange (PX) and Army post office (APO) were located at the airstrip. These were a major attraction for the troops.

The resupply convoys were becoming routine events. "Ad hoc" describes the composition, organization, and command and control of recent convoys. Troops volunteered for the somewhat dangerous task of convoy security for a variety of reasons: It offered a break from the routine, a chance to see some new scenery, and a chance to get away from our small base. The troops could shop at the PX and use the APO.

There had been little enemy activity in the weeks leading up to 21 May, a direct result and benefit of the allied incursion into Cambodia. Consequently, volunteering for security duty seemed like a safe bet. The security force consisted of no more than 15 personnel. The security detail would provide the "shotgun," or truck commander in current parlance, for the vehicles and also constitute the reaction force traveling in trucks at the front and rear of the convoy. Gun trucks were



"Wild Thing," Delta Company's gun truck, was equipped with two .50-caliber machine guns, a 7.62-millimeter machine gun, a six-barreled 7.62-millimeter "minigun," and a radio.

The high-pitched sound of the minigun's 6,000 rounds per minute struck fear into the hearts of the NVA.

either 2 1/2-ton or 5-ton cargo trucks with locally fabricated armored compartments mounted in the cargo bed. On occasion, the armored compartment was the hull of an M113 armored personnel carrier (APC). The trucks were usually armed with four machine guns—a mix of 7.62-millimeter M60s and .50-caliber M2s. On occasion, a 7.62-millimeter "minigun" was mounted. The minigun was a highly effective weapon. Designed for helicopter gunships, this electrically powered, six-barreled weapon could fire 6,000 rounds per minute. When fired, it made a terrifying sound. The NVA feared it.

The gun truck served several purposes. Obviously, it was a source of heavy firepower. It could fight off enemy attacks in ambush kill zones, allowing the other vehicles to clear out of the zone. The drivers, truck commanders, and gunners were brave men. The tactics employed, and the terrific firepower they possessed, made them very attractive targets for deadly and accurate enemy RPGs and machine gun fire.

We used a set pattern: the lead vehicle—an M151 1/4-ton vehicle, better known as a jeep—would be the convoy commander's, who was nicknamed the "Charlie Charlie." Following that would be the 2 1/2-ton cargo trucks, the famous "deuce-and-a-halfs." These included both mess and supply section trucks as well as the awesome gun truck.

Once the convoy was lined up for departure, it was standard operating procedure for the Charlie Charlie to conduct a convoy briefing. Incorporated in this briefing were the route, radio call signs, procedures for reaction to enemy contact, and the chain of command. On 21 May, no briefings were conducted, nor were rehearsals or precombat checks performed. We had become very complacent. This gross oversight would have serious implications later that day.

In recent weeks, our area of operations had been very quiet; the convoys had not encountered enemy activity. Closer to Dalat, we came across more and more local people. Small hamlets dotted the countryside. Woodcutters and farmers populated the villages, especially in the flatlands at the base of the mountains just outside the city. These peasants had one desire—to live their lives peacefully despite the war raging around them. Consequently, we saw more civilian vehicle traffic in this area. Drivers had to remain alert to trucks, pedestrians, farmers herding water buffalo, and youngsters playing near the road. Everyone remained alert and on the lookout for any possibility. As a result of the heavy foot and vehicle traffic, our convoy slowed down considerably and then came to an abrupt halt. Troops dismounted from the trucks and milled about haphazardly.

The Charlie Charlie drove back from the front of the convoy with the news that a civilian truck had swerved into the path of our lead 2 1/2-ton truck, resulting in a collision. We waited casually by our vehicles, not even bothering to take up defensive positions, thinking there was no real threat of an attack. We were lulled into the false security of thinking that we were too close to Dalat for enemy action. Moments after the Charlie Charlie drove off to inform the remaining vehicles in the convoy of the situation, an enormous explosion of rockets, command-detonated mines, and heavy automatic weapons fire erupted.

The Charlie Charlie's jeep came screaming back to our position. It was apparent from the look of sheer terror on his face that things had just taken a horribly ugly turn for the worse. The gunner of the jeep's pedestal-mounted M60 machine gun was crumpled in a bloody ball. Small arms fire had riddled the side of the jeep, severely wounding the machine gunner and destroying the radio. In short order, we had suffered a major attack and had lost a number of troops and the use of our radio.

While lying in the protection of a roadside ditch, we were able to look the length of the kill zone. From our position, we could see the friendly side of the road, and the convoy's trucks scattered about haphazardly. A few were on fire and smoking from well-placed RPG rounds. Several soldiers were lying in the road. From the looks of it, most of them were dead. A few could be seen moving, but when they did, a fusillade of enemy small arms fire would engulf them. Above the sounds of the enemy gunfire could be heard the unmistakable reports of the gun truck's heavy .50-caliber machine guns. If anything could

The UH-1 "Huey" served as a workhorse in Vietnam. At the scene of an ambush, casualties are loaded for evacuation to a field hospital.

Crewmen of "Wild Thing" frequently volunteered for dangerous duty as machine gunners.

break the enemy attack, it would be the overwhelming firepower of the gun truck. At least twice, the truck drove into and out of the kill zone. Our company gun truck, nicknamed "Wild Thing," was running back and forth, up and down the road. One soldier dismounted from the gun truck, retrieving the wounded and placing them in the relative safety of the armored box of the truck. With complete disregard for his own life, this young soldier pulled several wounded men to safety. Sadly, we had no medics to treat the wounded. This was an inexcusable omission.

The Charlie Charlie determined things were out of control and that we could not survive for long in our precarious position. He ordered us to retrieve the wounded closest to us, then mount up into the remaining vehicles and move out. We had his battered jeep and our overloaded 3/4-ton truck, plus a number of the 2 1/2-ton trucks and Wild Thing. We drove helter-skelter for Dalat.

We raced through the streets of Dalat, knowing we needed to get our wounded to the U.S. aid station quickly. Some of them were desperate for immediate attention. The realization that we needed to get back to the ambush site with additional ammunition, manpower, and heavier firepower was undeniable. We knew full well we had friends trapped in the kill zone.

While the medics tended to the wounded, we made final preparations for the trip back to the kill zone. We were reinforced with a platoon (-) of military police (MP) equipped with V-100 armored cars and a gun truck. The MP platoon leader took command and developed a plan.

The drive back down the mountain to the ambush site was short. We used the time to double- and triple-check our weapons, check ammunition, and make final preparations. The tasks we needed to accomplish, and the attention to detail required, helped keep the anticipation and fear in check. There was no traffic on the road from either direction.

We approached the kill zone, but when we were within one or two kilometers of the ambush site, we still could not hear any gunfire. As we drove around the curve leading to the site, we saw that the civilian truck that had collided with our 2 1/2-ton truck was gone. The MP V-100 armored cars moved quickly up to the near edge of the kill zone, near the spot where we had initially deployed from the 3/4-ton truck when the ambush started. The gun truck took up a firing position with a field of fire down the length of the kill zone.

The scene ahead was one of carnage. Lifeless bodies could be seen lying in the road. Smoke and the overwhelming smell of cordite hung over the position like a pall. It was hell. The armored cars and the gun truck were prepared to provide the dismounting troops with overwatching and suppressive fire.

It was obvious that the enemy was gone. Once again, his hit-and-run tactics had worked very well. We had to treat casualties and account for the soldiers we knew had been trapped in the kill zone. We had several men wounded, some grievously. Initial casualty reports stated that we had two confirmed dead. Two great young Americans had died while serving their nation. One of the fallen was a popular young sergeant. Later, word spread of his heroic act of pulling his wounded comrades into the gun truck.

Within a few minutes we accounted for all but one of our troops, those killed or wounded. There was no sign of the missing soldier anywhere. As is typical in any action, personnel accountability is critical. We had to determine the status of every member of the convoy force. As of that moment, everyone focused on finding the missing soldier or his remains. We were all horrified to think of what might have happened to him. Typically, the Vietcong and NVA killed junior enlisted men outright. No one wanted to ponder his fate. It was too horrible to consider.

This had been a very successful day for the NVA. The ambush had accomplished exactly what it wanted. For a very short time, the NVA enjoyed a brief tactical victory, albeit on a very small scale. The goal was to kill Americans, and it succeeded. A few more American soldiers would be going home in body bags.

Resupply convoys were an essential operation. There was no alternative. Units had to conduct routine convoys to Dalat, Long Binh, and Cam Ranh Bay. This was the only means of getting large and outsized equipment and bulk supplies such as fuel and ammunition. Convoys were, and remain, combat operations and must be treated as such. Even today, units must plan, resource, rehearse, and conduct convoys, since these are critical combat operations.

What lessons were learned from the events of 21 May 1970? What conclusions could be reached? They were simple, and all were leadership-related.

- German Field Marshal Erwin Rommel said more than a half century ago that "in battle, death sanctions all faults." On 21 May, we had a lot of faults:
  - No commissioned officer was detailed to lead the convoy.
  - No clear chain of command was delineated.
  - No operations order, rehearsal, or concept briefing was prepared or conducted.
  - No redundant communications systems were set up within the convoy.
  - No convoy briefing for the drivers, truck commanders, or security force was conducted.
  - No proper cross-leveling of noncommissioned officers among the trucks was executed.
  - No medic accompanied the convoy.
  - No reaction plan in the event of enemy contact was planned or executed.
  - Neither precombat checks nor serviceability inspections were conducted.
- Another Rommel dictum is that "the more sweat on the training ground, the less on the battleground." We failed to conduct rehearsals or establish drills in the event of an ambush. We could have minimized the effects of this catastrophe with a proper rehearsal.
- A convoy is a combat operation. It requires detailed planning, from predeparture to conclusion. Contingencies must be anticipated and plans developed to meet any possible enemy action.
- Failure to plan means that you are planning to fail. Should you fail to consider the enemy, you deserve what you get.

The only happy ending of the 21 May 1970 fight came in February 1973, when his NVA captors released the missing soldier. His name was never identified on any prisoner of war list, and he had long been given up for dead. His survival surprised and elated everyone. The great young men of the 102d Engineer Company and Delta Company, 815th Engineer Battalion, served their country with pride and distinction. The vast majority did their job, served their tours, and returned to civilian life. Today, they are middle-aged and have gotten on with their lives.

Colonel Saul is director of the Center for Army Lessons Learned at Fort Leavenworth, Kansas. He previously commanded the 10th Mountain Division (Light Infantry) Artillery, Fort Drum, New York. He was a sergeant in 1970 when he was assigned to Delta Company, 815th Engineer Battalion, 18th Engineer Brigade. He was commissioned in the Field Artillery Corps through Officer Candidate School at Fort Benning, Georgia. He has served two assignments with the British Army, as the exchange instructor at the Royal School of Artillery, and as the U.S. Army liaison officer to the British Army Staff College.

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Articles should be concise, straightforward, and in the active voice. If they contain attributable information or quotations not referenced in the text, provide appropriate endnotes. Text length should not exceed 2,000 words (about eight double-spaced pages). Shorter after-action-type articles and reviews of books on engineer topics are also welcome.

Include photos (with captions) and/or line diagrams that illustrate information in the article. Please do not include illustrations or photos in the text; instead, send each of them as a separate file. Do not embed photos in PowerPoint. If illustrations are in PowerPoint, avoid excessive use of color and shading. Save digital images at a resolution no lower than 200 dpi. Images copied from a Web site must be accompanied by copyright permission.

Provide a short paragraph that summarizes the content of the article. Also include a short biography, including your full name, rank, current unit, and job title; a list of your past assignments, experience, and education; your mailing address; and a fax number and commercial daytime telephone number.

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PEACEKEEPING FROM AN HHC PERSPECTIVE

By Captain Ralan Hill and Captain Kevin Stoll

The stability operations and support operations environment is a unique one that challenges engineer line companies and their supporting elements. Over the last decade, the American military has had increased involvement in nation-building and peacekeeping efforts, specifically in Bosnia and Kosovo. In Afghanistan and Iraq, the focus is on stability operations because of the continuing threats to soldiers who guard the perimeter, patrol outside the gates, and conduct sentry duties. The support soldiers most commonly found in a headquarters and headquarters company (HHC) face much different challenges. HHC commanders in stability operations and support operations environments have much greater flexibility than their maneuver or combat brethren when it comes to training, operations, and scheduling, and they should make the most of that opportunity. At issue are the female soldiers not found in line companies, the engineer reconnaissance team (ERT) normally assigned to the intelligence section, partnership possibilities with allied units, and mission-essential task list training conducted while deployed.

An HHC commander's flexibility extends beyond normal 9-to-5 working hours and varies by section and military occupational specialty (MOS). For cultural reasons, female soldiers will be in much higher demand. They will be tasked to conduct personal searches of women in the local civilian populace, both at entrances to base camps and during cordon-and-search operations outside the wire. Ironically, these female soldiers, who are not allowed in combat arms branches, will likely be exposed to greater risks and see more of the host nation than their male counterparts with whom they share an MOS. In a combat engineer battalion, the HHC is the only company with women and consequently will bear the entire burden of these taskings. The lesson learned is that when drawing up the deployment roster, it is absolutely necessary to take as many females as possible—especially from the lower enlisted ranks—since their unique qualifications will be in high demand. The mission rehearsal exercise, if conducted, must prepare the female soldiers for these tasks and the company must be prepared to backfill their normal duties through the cross-training of comparable male soldiers.

For the remaining male soldiers, the working environment will be almost like that in garrison. The battalion and company operations components will run continuous operations in shifts, but most other sections—such as maintenance, communications, and personnel—will work a more-or-less regular duty day unless their particular expertise is required outside the wire. The line companies work 24-hour operations with platoons or squads on 6-, 8-, or 12-hour shifts. While these line companies can be entirely consumed by shift work and patrols, an HHC can conduct Sergeant's Time Training and plan section-level, and even limited company-level, training. This additional training is productive for several reasons: First, the company improves proficiency in deficient mission-essential tasks. Second, the extra downtime normally associated with peacekeeping deployments is put to a productive end.

Mandatory schooling requirements also fit into the training scheme. While it may not be the case in Afghanistan or Iraq, in Kosovo it was much easier to find slots for required schools such as the Safety Officer Course, HAZ-11 and HAZ-12 Hazardous Cargo Certification, Logistics and Maintenance Supervisor Courses, and Small Arms Maintenance School. Being in a garrison-style environment while the line companies run 24-hour operations, HHCs derive a training benefit from being deployed that line companies do not experience. When deploying to such an environment, going in with a concrete and comprehensive training plan should allow the company to redeploy with a trained (T) rating in most mission-essential tasks.

The same reasoning applies to physical training (PT), which is easy to conduct six days a week as a company and individually by most soldiers in their off time. They do so to remain in shape and also because it helps alleviate boredom. Soldiers may spend too much time lifting weights in the gym and not enough time running or doing other cardiovascular activity, especially when the weather is cold and wet. But with appropriate supervision and planning, most soldiers' scores will increase an average of 20 or 30 points. This will match the fitness goals that should be set upon arrival in the country. Working these individual goals into a broader company goal will help keep soldiers focused and the company in shape. With the additional time, there is no reason not to schedule weight-training instruction, body fat composition assessment, nutrition counseling, and dietary supplement classes into the PT program. Incorporating these topics will ensure that soldiers learn from their chain of command (rather than from reading magazines), which should help prevent injuries and illnesses.

Some combat engineer battalions have an ERT composed of three to five soldiers, a noncommissioned officer, and some basic equipment. (See *Engineer* July 2002, page 47.) This element provides an even more critical and functional role in a stability operations and support operations environment. The teams conduct all the standard reconnaissance functions, especially route and bridge reconnaissance, which are often a critical aspect of the mission. Classifying and reclassifying bridges in the area will very likely become their primary mission. All the new infrastructure development that accompanies American military involvement in nation building makes this task ever-present. Invariably, each rotation wants to reconfirm the work of its predecessors and identify recently constructed or upgraded structures. The ERT represents the most effective and efficient tool for accomplishing this. Because the frequency of their trips allows them to recognize changes when they occur, ERT soldiers provide critical intelligence on the surrounding atmosphere and the feelings of the local inhabitants.

Soldiers in the ERT should become experts with the Javelin antitank missile, the Precision Lightweight Global Positioning System Receiver (PLGR), the Single-Channel Ground-to-Air Radio System (SINCGARS), and all components of the engineer reconnaissance kit. Their training should include not only reconnaissance missions (bridge, road, airfield, and obstacle) but also infantry drills such as call-for-fire techniques and land navigation. The explosive ordnance disposal (EOD) company that is often attached to engineers during stability operations and support operations rotations offers an ideal opportunity to train the ERT. Sending the ERT as a second security force with responding EOD teams is a unique opportunity that benefits all involved and builds the engineer task force into a collective team. These soldiers will probably go outside the wire more often than any other team or slice element in the battalion.

This is in sharp contrast to most of the other soldiers in an HHC, who may be outside the wire only twice: for arrival and departure. The supporting elements of an engineer battalion will find themselves isolated on the base camp, and this can be a significant problem if not properly monitored. However, living and working in a host nation within a multinational task force can present myriad solutions to the problem. These solutions surface primarily in local humanitarian work and joint training with

Soldiers receive salutes from children at an elementary school in Kosovo.

other similarly deployed nations. Local humanitarian work comes in all levels of commitment and involvement that range from one-day trips to a locally sponsored school to projects that require months of cooperative planning with local professional organizations. Even in the rare instance when these missions do not produce immediate and tangible results, they are still "feel-good" missions that are a boost to soldiers' morale and welfare.

Even with very little preparation, it is great to get off post, and doing so helps put a face on the American presence. Such a face is an immeasurable benefit to the overall message the military tries to send. In the fall of 2002, one of the most successful humanitarian work projects was the construction of a fence around an elementary school in Kosovo. After coordinating the project through the appropriate Kosovo force and local authorities, 16 soldiers, local relief workers, and students constructed a 100-meter-long, 1-meter-high chain-link fence around the school grounds. Actual construction time, in sporadic rain, was several hours, and the project culminated in good will, motivated soldiers, and a safer playground.

Partnership training with deployed soldiers from other allied nations—such as Britain, Russia, Greece, or Norway—is another unique opportunity to take advantage of during stability operations and support operations. Unlike the humanitarian efforts that lack military training objectives, allied partnerships are useful as joint-operations planning and interoperability training events. We cross-trained with the Royal British Engineers based in Pristina and conducted various training events with a Russian sister unit from within the American-led multinational brigade. These events facilitated interaction between engineers of different nations and enforced the need for continued information and technology sharing.

In addition to the inherent benefits of additional engineer training, these events provide a valuable morale, welfare, and recreational benefit. Sharing stories, customs, and soldiering skills allows personnel from different nations to interact and derive the social benefits of a multinational event. Keeping these training events informal and allowing plenty of time for the soldiers to interact with one another paid huge dividends.

With all these possibilities, the HHC role in a stability operations and support operations environment is ripe with uncommon opportunities for training and operations. The stresses are different from those in a garrison environment but still parallel that environment far more closely than in the line companies. By avoiding the line company mission-dictated shift schedule, it is possible to find exciting and innovative means of training soldiers, developing leaders, and evading boredom—all while accomplishing the mission at hand.

Captain Hill is the executive officer of Headquarters and Headquarters Company, 9th Engineer Battalion, Schweinfurt, Germany. Previous assignments include platoon leader and company executive officer, 44th Engineer Battalion, and platoon leader and company executive officer, 9th Engineer Battalion. He completed Kosovo Force Rotation 4A from April to November 2002.

Captain Stoll is the commander of Headquarters and Headquarters Company, 9th Engineer Battalion. Previous assignments include platoon leader, 2d Engineer Battalion; company executive officer, 864th Engineer Battalion (Combat) (Heavy); and battalion maintenance officer, 9th Engineer Battalion. He completed Kosovo Force Rotation 4A from April to November 2002.

Soldier's Creed

I am an American Soldier.

I am a Warrior and a member of a team. I serve the people of the United States and live the Army Values.

I will always place the mission first.

I will never accept defeat.

I will never quit.

I will never leave a fallen comrade.

I am disciplined, physically and mentally tough, trained, and proficient in my Warrior tasks and drills.

I always maintain my arms, my equipment, and myself.

I am an expert, and I am a professional.

I stand ready to deploy, engage, and destroy the enemies of the United States of America in close combat.

I am a guardian of freedom and the American way of life.

I am an American Soldier.

CTC Notes

Joint Readiness Training Center (JRTC)

Sapper Platoon Sergeant: Operating in a Lightfighter's Tactical Environment

By Sergeant First Class Anthony S. Sparks
and Captain Jason D. Williams

> *"NCOs, the backbone of the Army, train, lead, and take care of enlisted soldiers. They receive their authority from their oaths of office, law, rank structure, traditions, and regulations. This authority allows them to direct soldiers, take actions required to accomplish the mission, and enforce good order and discipline. NCOs represent officer leaders. They ensure their subordinates, along with their personal equipment, are prepared to function as effective unit and team members. While commissioned officers command, establish policy, and manage resources, NCOs conduct the Army's daily business."*
>
> Field Manual (FM) 22-100, *Army Leadership*

A prevalent trend at JRTC among rotational engineer units is the platoon sergeant (PSG) not understanding his role and exercising his authority to best influence the mission and ensure its accomplishment. The bottom line is that the PSG is not getting into the fight and making a difference. In a light environment, the engineer platoon habitually associates with an infantry task force. Often, the three sapper squads are task-organized in support of company maneuver teams and operate independently from the platoon headquarters element. With the expectation of having no subordinates upon task organization, the sapper PSG is faced with a constant dilemma—knowing his organizational role and knowing where his leadership is needed most in the tactical environment. The following paragraphs address this concern and include observations and feedback from the engineer observer-controllers (O-Cs) at JRTC.

Platoon Sergeant

The PSG is the senior noncommissioned officer (NCO) at the platoon level. He is the principal advisor and mentor to the platoon leader (PL). The PSG generally has 12 to 18 years of military experience and is rightfully expected to bring that experience and mentorship to bear and influence quick, accurate decisions that are in the best interest of the mission and the soldier. The connection between the chain of command and the NCO support channel is the senior NCO. Officers issue orders through the chain of command, but the senior NCO must know and understand the orders to issue effective implementing instructions through the NCO support channel. The role of the PSG was best defined in TC 22-6 (replaced by FM 7-22.7 *The Army Noncommissioned Officer Guide*): "When the platoon leader is present, the platoon sergeant is the primary assistant and advisor, with the responsibility of training and caring for soldiers. In the absence of the platoon leader, the platoon sergeant takes charge of the platoon." This serves as a guideline for the two basic combat functions of the sapper PSG: PL/assistant platoon leader (APL) and assistant task force engineer.

Platoon Leader/Assistant Platoon Leader

As the PL executes his duties as task force engineer participating in the maneuver task force military decision-making process (MDMP), the PSG must take a proactive approach in conducting parallel mission planning and preparation with his subordinate squad leaders. This involves the active supervision and execution of platoon troop leading procedures (TLPs). With the PL's intent and the receipt of developing mission-critical information, the PSG can—

- Issue warning orders (WARNORDS) (as detailed as possible).
- Make a tentative plan; assign critical responsibilities to facilitate mission preparation, precombat checks (PCCs), and rehearsals.
- Initiate necessary movement; coordinate task organization changes or movement to a new patrol base or assembly area.
- Conduct reconnaissance (map, route, objective).
- Complete the plan; implement changes based on the results of the reconnaissance and the approved scheme of engineer operations from the MDMP.
- Issue the operation order (OPORD), if tasked by the PL.
- Supervise and assess; conduct leader precombat inspections (PCIs) and monitor rehearsals at the squad, platoon, and combined arms levels.

Under the factors of mission, enemy, terrain, troops, time available, and civilian considerations (METT-TC), the maneuver commander's guidance, and/or the PL's instructions, the PSG must be assigned a distinct role for the execution phase of the operation. This may include serving as a PL/APL in a platoon-level operation, maneuvering with an engineer main effort squad, or battletracking in the task force tactical operations center (TOC) as the assistant task force engineer. The goal is to find the combination and balance of engineer leadership that best supports the task force and allows the engineer platoon to successfully accomplish the mission.

Assistant Task Force Engineer

The sapper PSG inherently must share the responsibility of manning the task force engineer cell (TFEC). In the absence of the PL, the PSG serves as the engineer Battlefield Operating System (BOS) representative on the task force battle staff. His duties include battletracking on current operations; maintaining communications and reporting with higher and subordinate headquarters; and managing critical engineer information—such as enemy and friendly minefields, route status within the area of responsibility, and combat power. The PSG must maintain an excellent situational awareness and possess a strong knowledge of engineer systems, their capabilities and doctrinal employment, and tactics. Ultimately, he must be confident in his ability to execute his role as an engineer BOS advisor to senior maneuver leadership.

Observer-Controller Observations

- The majority of engineer PSGs rotating through the JRTC are "fast-tracking" staff sergeants (with 8 to 12 years of military experience) who excelled as squad leaders in a tactical environment but are struggling to fulfill the responsibilities of a competent PSG. They have little to no experience in a TOC, do not possess the engineer doctrinal knowledge and understanding of task force-level operations, and lack the confidence and credibility with the maneuver community to be a senior-level advisor.
- PSGs revert back to the mentality of just managing the "beans and bullets" aspect of operations. This hinders the PL's ability to effectively manage the platoon's timeline. The PSG has little involvement in platoon TLPs; they are left to the PL to execute upon completion of the task force MDMP or pushed down to the squad leaders for decentralized execution.
- A "TOC avoidance" syndrome causes PSGs to push that entire responsibility on the PL. This has been attributed to a number of factors: there is no battle staff NCO course qualification; the TOC is an unfamiliar environment that might show the senior NCO's "true" lack of experience in the presence of his maneuver brethren; the PSG simply wants to stay forward with the soldiers and where the "real" fight is.
- The PSG rarely conducts battlefield circulation. This impacts his ability to gain the "pulse" of the platoon and implement action when needs are not being addressed. Soldier welfare and logistic concerns are often overlooked when squads are task-organized away from the platoon headquarters in various command/support relationships.
- The PSG often has a poor relationship with the PL. The PSG shows little patience in coordinating with and mentoring the junior lieutenant who has an incredible dual responsibility as PL and task force engineer (often assigned with less than 18 months of military service). This severely strains the platoon's ability to plan, prepare, and execute, and it ultimately impacts the unit's ability to support the task force and accomplish the mission.

Summary

The PSG is the key assistant and advisor to the PL—both as a task force engineer in the TOC and forward with the platoon on the battlefield. In the absence of the PL, the PSG commands the platoon and acts as the senior engineer advisor to the task force. He is the driving force behind the platoon's prebattle preparation, and he must be ready to lead from the front when called upon. The PL and PSG must work together effectively to find a balance of leadership and position themselves accordingly to fight and win on the battlefield.

The following checklist of responsibilities serves as a guide for the sapper PSG when determining where he is needed most to influence operations and impact mission accomplishment:

- Assist and coordinate with the PL. The PSG should also be prepared to assume the PL's duties, as required.
- Execute TLPs and briefing orders in the absence of the PL.
- Become involved early in the planning process to provide quality control in the execution of engineer missions and logistical operations.
- Execute duties as the assistant task force engineer has directed.
- Check on the welfare of the soldier as a second set of eyes for the PL.
- Enforce standards and the tactical standard operating procedure.
- Supervise platoon logistics, maintenance, communications, field hygiene, and medical evacuation operations.
- Lead, supervise, inspect, observe, and assess matters that the PL designates.

Sergeant First Class Sparks is a light engineer platoon senior NCO observer-controller. Previous assignments include PSG and squad leader, Charlie Company, 307th Engineer Battalion (Airborne); operations sergeant, 554th Engineer Battalion; and squad leader, 562d Engineer Company, 172d Infantry Brigade (Separate) and Alpha Company, 20th Engineer Battalion (Corps) (Wheeled).

Captain Williams is a light engineer platoon senior observer-controller. Previous assignments include commander, Bravo Company, 65th Engineer Battalion (Light); brigade engineer, 2d Brigade, 25th Infantry Division; adjutant, executive officer, and platoon leader, 588th Engineer Battalion (Mechanized), 4th Infantry Division.

National Training Center (NTC)

Simultaneous Explosive Reductions

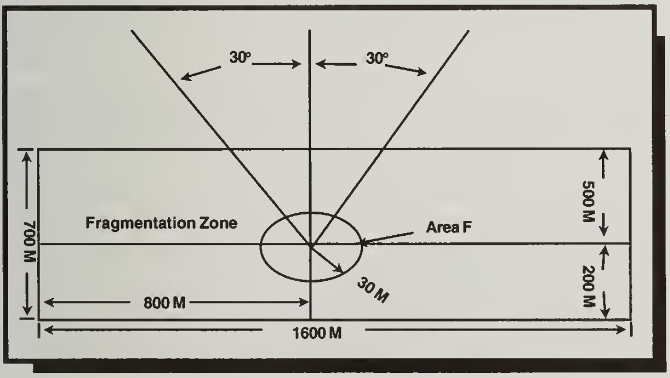
By Captain Kirk Gibbs

Live-fire operations at NTC are an excellent training opportunity for engineers. NTC is the only training environment in the continental United States where units may regularly fire the M58 high-explosive mine-clearing line charge (MICLIC). Often, reverse planning based on the overwatching enemy drives the unit to conduct a brigade-level breaching operation. This requires two lanes through a complex obstacle in order to assault a task force onto the objective. Units often choose to weight the brigade's breach force with at least two MICLICs to quickly create two lanes using explosive reduction techniques. This raises the question, "Should we reduce at two points of breach simultaneously?" The MICLIC surface danger zone (SDZ), as well as the unit's ability to conduct rehearsals, should drive this decision. The answer to the question can be "yes." However, units should consider the following points when planning and preparing for simultaneous explosive reductions:

MICLIC SDZ

The NTC-approved MICLIC SDZ (shown below) is based on Department of the Army (DA) Pamphlet (Pam) 385-63, *Range Safety,* with each distance in the fragmentation zone rounded up to the nearest 100 meters. The SDZ is divided into Area F; the 30-meter radius around the MICLIC; and the fragmentation zone of 500 meters forward, 200 meters to the rear, and 800 meters to each side of the MICLIC. DA Pam 385-63 states who can be in Area F and the fragmentation zone when the MICLIC is fired:

- Only the MICLIC, armored towing vehicle, and M1 tank with mine-clearing blade or roller (if the unit chooses to fire over a tank) may remain in Area F.
- Elements of the breach force and support force may be inside the fragmentation zone but must be behind the MICLIC firing line outside of Area F and must be "buttoned up."



Points of Breach

With these mandatory control measures, units that conduct simultaneous explosive reductions must ensure that points of breach are at least 800 meters apart. The reasons for this are twofold:

- One enemy artillery-delivered scatterable minefield (200 by 800 meters) can close two lanes if they are not at least 800 meters apart.
- In the event of a misfire on one lane, the unit can continue to create the second lane by dismounting engineers to mark the lane and sending the assault force through to the farside objective. In every type of misfire procedure for a rocket or charge, the unit must wait 30 minutes before approaching the launcher or charge, if it has been deployed. This means that within the SDZ, all vehicles must maintain a buttoned-up status, and no vehicles can move forward of the MICLIC firing line.

Summary

None of these procedures are specific to NTC and the NTC exercise operating procedures. Leaders should consider them during all phases of the operation whether it is a training or combat operation. To adequately synchronize any combined arms breaching operation, units must conduct full-force or, at the very least, reduced-force rehearsals where clearance of the SDZ and reporting procedures are adequately practiced. This is vital to successfully reducing two lanes through an enemy obstacle and maintaining the momentum of the brigade's attack.

The Sidewinder MICLIC Guide is available at *<http://www.irwin.army.mil/sidewinder/MICLIC%20WEB%20PAGE/index.htm>*. To obtain a copy of this guide in a compact disc format, e-mail *<sw04t@irwin.army.mil>* and provide a valid unit address.

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Explosive Ordnance Disposal Integration

By Captain Mark R. Faria

The explosive ordnance disposal (EOD) field is quickly becoming a more visible and effective force multiplier on the battlefield. The role of EOD units is changing because doctrine now allows for a company or company (-) to support a brigade combat team (BCT) (based on unexploded ordnance [UXO] threat and saturation) instead of operating at echelons above corps. Combat commanders are seeing the importance of integrating EOD units and their capabilities into mission planning. NTC is keeping pace with these changes, and current scenarios force EOD integration into the engineer battalion and BCT operations.

The EOD company commander serves as the theater EOD staff officer, as well as a company commander, in smaller operations without an EOD battalion element in theater. Current BCT-sized operations—such as in Bosnia and Kosovo and at NTC—have an EOD company or company (-) attached to the engineer battalion. This task organization must not impede the EOD commander's ability to discuss explosive-related issues with the BCT commander. It is vital that both the engineers and the BCT fully understand EOD capabilities. Two critical integration issues have emerged: the location of the EOD company (-) command post and EOD integration into the military decision-making process (MDMP).

EOD Command Post Location

EOD doctrine does not direct that the EOD command post be colocated with the brigade tactical operations center (TOC), but there are many benefits to doing this. Trends at NTC show that when the EOD command post sets up in the engineer/brigade TOC, it can provide input into the risk management process, incorporate EOD capabilities into the BCT fight, participate in the MDMP, integrate with all supporting elements (such as civil affairs and military police), and battletrack to determine the extent of UXO contamination on the battlefield. Trends also show that EOD units operating out of the brigade support area (BSA) seldom receive a task and purpose in support of the BCT fight. These units fall into a reactive mode where they respond to UXO that are called in but remain reactive instead of proactive in incorporating EOD capabilities.

MDMP Integration

The EOD commander has two courses of action (COA) to integrate into the MDMP:

- COA 1. The EOD commander briefs mission analysis and provides visibility of UXO threat to the BCT as well as how he can mitigate these risks. The benefit to this is that no one understands EOD capabilities and limitations better than the commander. He can immediately request additional support such as security or haul assets if required. The problem with this COA is that it takes the commander away from his unit for long periods of time. EOD companies don't have an executive officer to help run the unit or participate in the MDMP.
- COA 2. The engineer battalion S3 or assistant brigade engineer (ABE) receives input from the EOD commander before each MDMP cycle and ensures that the input is brought up to BCT level. The benefit to this COA is the experience of the field grade officer who fully understands the MDMP and the big picture of the BCT mission. Both he and the ABE also have a habitual association with the BCT and thus a better working relationship with the staff. This COA also frees up a considerable amount of time for the EOD commander to focus on his company. The limitations of this COA are that the S3 is extremely busy, and his time in the MDMP is somewhat limited. The ABE must not become so overwhelmed in engineer specifics that he forgets about the EOD company. Both staff members must have a full understanding of EOD capabilities to ensure a realistic task and purpose for the EOD company.

Summary

The BCT and engineer battalion must consider EOD capabilities in support of their mission. EOD input into the MDMP ensures the anticipatory use of assets rather than the reactive use. This process is made possible by colocating the EOD command post at the engineer and BCT TOC and allows the EOD commander to accomplish his role as the theater EOD staff officer.

For additional information on EOD operations at NTC, visit the Sidewinder Web site at <*http://www.irwin.army.mil/sidewinder/index.htm*>.

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Obstacle and Class IV/V Supply Point Support Teams

By Major Michael W. Rose

Typically, BCTs have 24 to 36 hours to prepare a defense at NTC. Given the time it takes to begin engagement area development, even relying primarily on scatterable mine systems and special-purpose munitions versus conventional row mining, time is clearly the limiting factor for combat engineers and the BCT. While the BCT can use brigade-directed obstacles in conjunction with a directed scheme of maneuver to jump-start the effort and train to rapidly conduct engagement area development, the best way to increase obstacle productivity is to augment the engineers.

Support Teams

The goal of augmentation is to keep as many engineers as possible executing tasks that require the most expertise instead of tasks that any soldier can execute. Units can achieve this goal by providing support at the Class IV/V supply points and emplacing minefield perimeter fence or other constructed obstacles. While many units specifically task units to provide this support in an order, adding the requirement and any additional coordinating instructions to the maneuver unit's standard operating procedures (SOP) will greatly contribute to the likelihood of getting support with the right leadership and equipment. Figures 1 and 2 on page 67 show a sample SOP for both obstacle and Class IV/V supply point support teams. These SOP cards were developed by the 8th Engineer

CARD 445 – Class IV/V Support Team

1. PURPOSE: The Class IV/V support team is a squad-sized organization of soldiers who, on order, establish the task force (TF) Class IV/V point and reorganize the combat configured loads (CCLs) (throughput from corps level) into unit/obstacle-specific packages and/or reconfigure CCLs for back haul or follow-on missions.

2. COMPOSITION: Each ground maneuver TF will resource one Class IV/V support team consisting of the following:

- 1 NCO (for command and control [C2]) and 7 soldiers
- Sleep gear and wet and cold weather gear
- 3 five-gallon water cans
- Minimum of 1 meal, ready to eat (MRE) per soldier
- Transportation and commo for the team
- 1 Engineer NCO who will provide a Class IV/V equipment package consisting of—
  - √ 10 pair of leather work gloves
  - √ 3 pair of metal strapping cutters
  - √ 2 pair of banding crimpers
  - √ 2 pair of banding rachet machines
  - √ 100 feet of 1/2-inch banding material
  - √ 50 each 1/2-inch banding clips

3. RESPONSIBILITIES:

BDE	TF	EN CO
• Identify all Class IV/V support team coordinating instructions in a published operational order (OPORD)/fragmentary order(FRAGO) to TFs. • Include the following in the coordinating instructions: - Adjustments to composition - Linkup point and time - Duration of requirement	• Provide a standard Class IV/V support team (see composition above) when specified in the brigade OPORD/FRAGO. • Execute linkup of the Class IV/V support team as specified in the order.	• Coordinate linkup with supported TF. • Verify or adjust the linkup point and time as required. • Verify that the Class IV/V support team is properly manned and equipped. • Efficiently employ the Class IV/V support team and report release to the TF tactical operations center.

Figure 1

CARD 447 – Obstacle Support Team

1. PURPOSE: An obstacle support team (OST) is a platoon-sized organization of soldiers trained in basic obstacle construction who, on order, move forward to a designated task force (TF) engagement area to assist and augment combat engineer soldiers constructing the TF defensive plan. OSTs will construct single-strand and triple-standard concertina fences, and dig holes for mines under the direction of an engineer NCO. These fratricide fences will support the use of both conventional and scatterable munitions.

2. COMPOSITION: Each ground maneuver TF in 3d Brigade Combat Team will resource one OST. Each OST consists of the following:

- 30 soldiers (a minimum of 3 NCOs and a designated NCOIC)
- 1 OST equipment package consisting of—
  - √ 5 picket pounders
  - √ 50 pair of leather work gloves
  - √ 5 long-handled shovels
  - √ 8 long-handled picks
- 1 water trailer or 10 five-gallon water cans
- Individual weapons, night-vision devices, sleep gear, wet and cold weather gear, and 1 meal, ready to eat (MRE) per soldier
- 2 light medium tactical vehicles (LMTVs) (for transportation)
- 1 C2 vehicle with operator
- 2 company grade officer heavy expanded-mobility tactical trucks (HEMTTs) with operators

3. RESPONSIBILITIES:

BDE	TF	EN CO
• Identify all OST coordinating instructions in a published OPORD/FRAGO to TFs. • Include the following in the coordinating instructions: - Adjustments to composition - OST linkup point and time - Duration of requirement	• Provide a standard OST (see composition above) when specified in the brigade OPORD/FRAGO. • Execute linkup of OST support team as specified in the order.	• Coordinate linkup with supported TF. • Verify or adjust the designated linkup point and time as required. • Verify that the OST is properly manned and equipped. • Employ the OST based on TF priorities. • Report release of the OST to the TF tactical operations center.

Figure 2

Battalion, which habitually provides direct support to 3d Brigade, 1st Cavalry Division.

Summary

Establishing support to defensive preparation in the SOP and training to efficiently use properly led and resourced teams to increase obstacle productivity is one procedure units can adopt to help defeat the greatest enemy on the battlefield—time.

"The loss of time is irreparable in war."

—Napoleon

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ENGINEER UPDATE

Commercial numbers are (573) 563-xxxx and Defense System Network (DSN) numbers are 676-xxxx unless otherwise noted.

Directorate of Training Development (DOTD)

Mission Training Plans (MTPs). Army leaders are responsible for training units to established doctrinal standards, and evaluations of training are a key element in this process. The Army Training and Evaluation Programs (ARTEPs)/MTPs are the documents that hold the consolidated lists of tasks associated with units. This is a consolidated reference of the tasks, conditions, and standards for each collective task that a type of unit is expected to perform.

The development process of an MTP begins with the Department of the Army (DA)-approved table of organization and equipment (TOE). This document expresses the personnel and equipment authorized for a type of unit. The DA mission statement is used, in conjunction with the TOE, to determine specified and implied mission tasks that should be reflected in the MTP. These documents form the basis for the draft MTP. Modified TOEs (MTOEs) are not used because of the frequency of changes and because MTOEs usually reflect changes in equipment and personnel, not in doctrine. Each unit is given a TOE number to distinguish it from all other units. The number is devised so that a unit's MTP will align by the type of TOE it is under. An example is that a TOE with a 335F000 aligns with MTP 5-335-60.

The Army no longer produces printed copies of MTPs, but they can be downloaded through the Reimer Digital Library (RDL) Services at Army Knowledge Online. (See page 69 for details.) It is important that leaders research the information available and learn to navigate the site. There are two sections within the RDL Services that provide access to MTPs, field manuals, and many other military publications. To find your unit's MTP, enter RDL Services and select *Enter the Library* or *The Library*. You will then see the two options available: *Official Departmental Publications* and *Commandant-Approved Individual and Collective Training Support Materials*. Both sites contain MTPs. The difference is that MTPs found on the *Official Departmental Publications* site have been authenticated by the United States Army Publishing Agency (USAPA). MTPs found on the *Commandant-Approved* site are final, approved documents awaiting USAPA authentication to be loaded onto the *Official Departmental Publications* site. Your unit MTPs will be found in one, or both, of these two locations. Select one of the locations. In the *Type* column on the left, highlight *Mission Training Plans* if searching the *Official Departmental Publications* section. Highlight *Bn. Ex. Eval.* (battalion exercise evaluation) if searching *Commandant-Approved Training*. Scroll down the list of schools in the *School* column on the right and highlight *Engineer*. Click *Submit*. Select the ARTEP/MTP of your choice.

If there is a problem with the contents of an MTP, you can submit a request for change by telephone, e-mail, or regular mail. You will receive a reply within 24 hours of receipt of the comments. The proponent for engineer collective training is the Engineer Warfighter Division, Warfighter Department, Directorate of Training Development.

POC can be reached at (573) 563-4102; DSN 676-4102; or e-mail *<atztdtwf@wood.army.mil>*. You may also mail comments on DA Form 2028, *Recommended Changes to Publications and Blank Forms*, to the U.S. Army Maneuver Support Center, Directorate of Training Development, Warfighter Department, 320 MANSCEN Loop, Suite 203, Fort Leonard Wood, Missouri 65473-8929.

Standards in Training Commission (STRAC). DA Pamphlet (Pam) 350-38, *Standards in Weapons Training*, is a product of the STRAC Council of Colonels (COC). The STRAC Working Group (SWG)—comprised of representatives from each of the Army proponents, all major commands (MACOMs), and the DA staff members—presents issues affecting force modernization and readiness to the STRAC COC, which analyzes the issues, works possible solutions, and prepares recommendations.

The standards and strategies contained in DA Pam 350-38 are reviewed biannually by the STRAC COC to identify and correct any changes in the Army's training strategy or the amount and type of training ammunition authorized for each weapon system and training event. The results of the reviews, if approved, are reflected in DA Pam 350-38. Requests for changes or questions can be addressed through your MACOM representative or the MANSCEN STRAC manager.

POC is Mr. Bobby Skinner at (573) 596-0131, ext. 36243; DSN 676-6243; or e-mail *<atztdtwf@wood.army.mil>*.

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Combined Arms Training Strategy (CATS). A CATS provides leaders with the Army's overarching concepts to develop training strategies for the Total Force at the institutional, unit, and self-instruction level. CATSs fully integrate all elements of Active and Reserve Component training that will prepare the Army to fight across the entire spectrum of military operations. It also supports the versatility required of a force projection Army. CATSs serve as the Army's format for efficiently and effectively managing training for units in the field and in the conduct of institutional training. It provides a tool for identifying, quantifying, and justifying training resources required now and in the future.

CATSs provide a standardized, structured doctrinal training strategy that will train soldiers and units to standard. It provides a means for managing and planning unit training and forecasting necessary resources. It captures the tasks that are taught in institutions, in units, and through self-development and the resources required to train those tasks to standard. A task-based, combined arms strategy also provides leaders with standardized guidance on the frequency with which a task should be trained to achieve desired levels of proficiency to ensure readiness to meet mission-essential task list requirements.

Units can access CATSs through the Standardized Automated Testing System (SATS), as well as on the Army Training Support Center's Reimer Digital Library. Access to CATSs can also be made through the CATS Web site at *<http://leav-www.army.mil/ctd/cats/faq.htm#whatiscats>*. Many TRADOC proponent schools are loading CATSs on their Web sites.

POC is Mr. Joe Toth at (573) 396-0131, ext. 37821; DSN 676-6243; or e-mail *<atztdtwf@wood.army.mil>*.

Accessing Army Training Publications Through AKO

There is a new version of the Reimer Digital Library (RDL) that can be accessed through Army Knowledge Online (AKO). If you are active Army, Army Reserve, National Guard, retired Army, or a Department of the Army civilian, you may access the new Army Training Information Architecture-Migrated (ATIA-M) RDL for Army training and doctrinal publications using your AKO User ID and Password.

1. To view documents online, go to *<http://www.train.army.mil/>*.
2. Read the disclaimer and then click on the *Click here to go to your Training Homepage* bar at the bottom.
3. Click on the *Login* button in the upper right-hand corner. (A Security Alert box will appear. Click *OK*. Another Security Alert box will appear. Click *Yes*.)
4. Type in your AKO User ID and Password and click on *Login*.
5. Your name should appear at the top of the page. Next click on the *My Account* tab.
6. If you have not yet migrated your RDL permissions, there will be a paragraph at the top of the page with a hot link to do so. Click on the link.
7. Click on the *RDL Services* tab.
8. Choose either *Official Departmental Publications* or *Commandant Approved Training*.
9. In the column on the left, highlight *Any* or one of the types of publications. Scroll down the list of schools on the right and highlight *Engineer*.
10. Click *Submit*.
11. Scroll down the list to the publication of your choice.

You only need to migrate your RDL account one time. From that time on, you will be able to use your AKO User ID and Password to download training and doctrinal publications from the new Web site.

If you do not already have an AKO account, please go to the Army homepage at *<http://www.army.mil>*. Look in the upper right-hand corner, select *Army Knowledge Online* and create an account.

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